BID DOCUMENTS

BLACKBURN RESOURCE RECOVERY FACILITY OPERATOR'S BUILDING

CATAWBA COUNTY

CATAWBA COUNTY, NORTH CAROLINA

mcgill Shaping Communities Together

BID DOCUMENTS

BLACKBURN RESOURCE RECOVERY FACILITY OPERATOR'S BUILDING

CATAWBA COUNTY

CATAWBA COUNTY, NORTH CAROLINA

COLLIN SELMAN, PE

55 Broad Street
Asheville, NC, 28801
828-252-0575
Firm License No.: C-0459

SEPTEMBER 2026

PROJECT NO. 26.00701

OPERATOR'S BUILDING

MCGILL PROJECT NO. 26.00701
OWNERS BID NO. 27-1005

BLACKBURN RESOURCE RECOVERY FACILITY

CATAWBA COUNTY, NORTH CAROLINA

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Civil Scope
Plan Sheets:

G-001	C-200
G-002	C-300
C-001	C-500 to C-501
C-100	

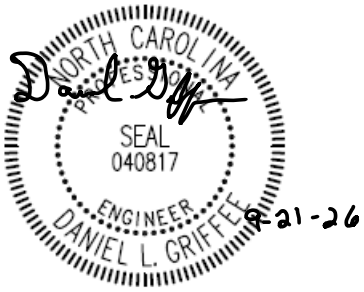
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S101
S201
S301

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M-001	P-001
M-101	P-101
M-201	P-501
	P-601



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E-101
E-201
E-501
E-601



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Architectural Scope
Plan Sheets:

Cover	A210
AS101	A301
A100 to A101	A310
A110	A401 to A402
A201	A501



TABLE OF CONTENTS

DIVISION 00 - BIDDING AND CONTRACT REQUIREMENTS

ADVERTISEMENT TO BID
MODIFIED INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACTS (EJCDC Form C-200)
BID FORM (EJCDC Form C-410) AND BID SCHEDULE
NON-COLLUSIVE AFFIDAVIT
NOTICE OF AWARD (EJCDC Form C-510)
CONSTRUCTION CONTRACT
GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION
RULES IMPLEMENTING MEDIATED SETTLEMENT CONFERENCES IN CATAWBA COUNTY
INSURANCE CERTIFICATES
NOTICE TO PROCEED (EJCDC Form C-550)
MODIFIED GENERAL CONDITIONS (EJCDC Form C-700)
NC ONE CALL NOTIFICATION
CONTRACTOR'S APPLICATION FOR PAYMENT (EJCDC Form C-620)
CERTIFICATE OF SUBSTANTIAL COMPLETION (EJCDC Form C-625)

DIVISION 01 - GENERAL REQUIREMENTS

013000 MEASUREMENT AND PAYMENT

DIVISION 02 - EXISTING CONDITIONS

024116 DEMOLITION

DIVISION 03 - CONCRETE

033000 CAST-IN-PLACE CONCRETE

DIVISION 04 - MASONRY

042200 CONCRETE MASONRY UNITS

DIVISION 05 - METALS

054000 COLD-FORMED METAL FRAMING
054400 COLD-FORMED METAL TRUSSES

DIVISION 6 - WOOD AND PLASTIC

061000 ROUGH CARPENTRY
062000 FINISH CARPENTRY

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

072100 BATT INSULATION
072110 SOUND ATTENUATION BATTS
072140 RIGID INSULATION
072400 EXTERIOR INSULATION & FINISH SYSTEM
072500 WATER RESISTIVE BARRIERS
072600 VAPOR RETARDERS
072619 HUMIDITY DEPENDENT VAPOR RETARDERS
074113 METAL ROOF PANELS
074213 METAL WALL PANELS
079200 JOINT SEALANTS

DIVISION 8 - DOORS AND WINDOWS

081200 HOLLOW METAL DOORS & FRAMES
081216 INTERIOR ALUMINUM DOORS & FRAMES
081416 FLUSH WOOD DOORS
084113 ALUMINUM FRAMED ENTRANCES & STOREFRONTS
085113 EXTERIOR ALUMINUM WINDOWS
085200 WOOD WINDOWS

087100 DOOR HARDWARE
088000 GLAZING

DIVISION 9 - FINISHES

092216 NON-LOADBEARING METAL FRAMING
092900 GYPSUM BOARD ASSEMBLIES
095100 SUSPENDED ACOUSTICAL CEILINGS
099000 PAINTING AND COATING

DIVISION 10 - SPECIALTIES

102113.19 TOILET COMPARTMENTS
102800 TOILET ROOM ACCESSORIES
104413 FIRE EXTINGUISHERS, CABINETS, & ACCESSORIES

DIVISION 22 - PLUMBING

220000 PLUBMING GENERAL REQUIREMENTS
220503 ELECTRICAL REQUIREMENTS OF PLUMBING WORK
220700 PLUMBING INSULATION
221000 PLUMBING PIPING
221005 PLUMBING SPECIALTIES
223000 PLUMBING EQUIPMENT
224000 PLUMBING FIXTURES

DIVISION 23 - MECHANICAL

230000 MECHANICAL GENERAL REQUIREMENTS
230503 ELECTRIALL REQUIREMENTS OF MECHANICAL WORK
230553 MECHANICAL IDENTIFICATION
230593 TESTING, ADJUSTING, AND BALANCING
230700 MECHANICAL INSULATION
232300 REFRIGERANT PIPING AND SPECIALTIES
233100 DUCTWORK AND ACCESSORIES
233400 FANS
233700 AIR DISTRIBUTION DEVICES
233718 LOUVERS
237300 AIR HANDLING UNITS
238127 DX CONDENSING UNITS

DIVISION 26 - ELECTRICAL

260519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
260548.16 SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS
260553 IDENTIFICATION FOR ELECTRICAL SYSTEMS
262213 LOW-VOLTAGE DISTRIBUTION TRANSFORMERS
262416 PANELBOARDS
262726 WIRING DEVICES
262816 ENCLOSED SWITCHES AND CIRCUIT BREAKERS
SURGE PROTECTION DEVICES FOR LOW-VOLTAGE ELECTRICAL
264313 POWER CIRCUITS

DIVISION 31 - EARTHWORK

312000 EARTH MOVING
312230 AGGREGATE BASE COURSE
312271 RIP RAP

DIVISION 32 - EXTERIOR IMPROVEMENTS

321216 BITUMINOUS PAVING
321313 CONCRETE PAVING
322905 RESTORATION OF SURFACES
329200 TURF AND GRASSES

DIVISION 33 - UTILITIES

330500	COMMON WORK RESULTS FOR UTILITIES
332660	WATER PIPE AND APPURTENANCES
332700	SANITARY SEWER PIPE AND APPURTENANCES
334100	STORM DRAINAGE MATERIALS

APPENDICES

APPENDIX 1	DRAWING PLAN SET
APPENDIX 2	PERMIT DOCUMENTATION
APPENDIX 3	PRE-BID MEETING INFORMATION

ADVERTISEMENT FOR BIDS
BID NO. 27-1005
Blackburn Resource Recovery Facility Operator's Building
Catawba County, North Carolina
Issued: September 23, 2026

Sealed Bids for the **Blackburn Resource Recovery Facility (BRRF) Operator's Building Project** will be received, by **Catawba County**, in the **2nd floor meeting room, Government Center, located at 25 Government Drive, Newton, North Carolina 28658**, until **3:00 PM** local time **October 22, 2026,** at which time the Bids which have been duly received will be publicly opened and read.

THE PROJECT GENERALLY CONSISTS OF site preparation and construction of an approximately 2,020 square foot metal frame building to be used by the BRRF's on-site operators. The site work will include demolition of existing pavement and select site features, light grading for the building pad, a concrete sidewalk surrounding the new building, and heavy duty asphalt pavement for the new parking and driveway areas. The building itself includes two vestibule entrances, a locker space, a large open training and gathering area with a kitchenette, two restrooms, a storage closet, and a mechanical closet.

A **mandatory** pre-bid conference will be held at **10:00 AM** local time on October 8, 2026, at the **Blackburn Resource Recovery Facility, 4017 Rocky Ford Road, Newton, North Carolina 28658**. Bids will not be accepted from Bidders who do not attend the mandatory pre-bid conference. The purpose of the mandatory conference and site visit is for prospective Contractors to apprise themselves of the conditions and requirements that will affect the performance of work called for in the Bid Documents. Any Bidders who are not present by 10:00 AM will not be able to participate in the pre-bid conference.

Bids will be received for a single prime Contract. Bids shall be on a lump sum and unit price basis as indicated in the Bid Form.

Digital copies of the Bid Documents are available at www.mcgillassociates.com. These documents may be downloaded at no cost by entering **Quest Project Number 10385959** in the search bar. **For assistance and free membership, contact Quest CDN at (952) 233-1632 or info@questcdn.com.** To be considered a registered plan holder, registration with Quest is required for tracking, addenda distribution, and confirmation of receipts.

Bid Documents may also be downloaded from the following designated County website at no charge: https://www.catawbacountync.gov/county-services/purchasing/bid-notices/ This website will be updated periodically with addenda and other information relevant to submitting a Bid for the Project. In addition, Bid Documents will be available for inspection, by appointment, at the Catawba County Purchasing Department, 25 Government Drive, Newton, North Carolina 28658, Phone: 828-465-8224.

All official notifications, addenda, and other Bidding Documents will be offered only as detailed in this Advertisement. Neither Owner nor Engineer will be responsible for Bidding Documents, including addenda, if any, obtained from sources other than the methods listed herein.

Questions regarding the intent or Scope of Work must be delivered in writing to Scott Burwell via email (scott.burwell@mcgillassociates.com). To be given due consideration, questions must be received by 5:00 pm on October 15, 2026. Responses will be issued via addendum through the Quest CDN site and the designated County website for use by prospective bidders.

The table below shows the intended bid schedule for this Project. Owner will make every effort to adhere to this schedule:

Event	Responsibility	Date and Time
Advertisement Issued	Owner	September 23, 2026
Pre-Bid Conference	Owner/Contractor	October 8, 2026 at 10:00 AM ET
Submit Written Questions	Contractor	October 15, 2026 by 5:00 PM ET
Provide Written Answers	Owner	October 19, 2026 by 5:00 PM ET
Bid Opening	Contractor	October 22, 2026 at 3:00 PM ET
Contract Award	Owner	TBA

If submitting Bid by mail, the Bid must be submitted in a sealed envelope, plainly marked on the outside as described in the Instructions for Bidders, and mailed to the address shown below:

Mailing address for delivery of bid via US Postal Service	Office Address of delivery by any other method (hand delivery, overnight, or any other carrier)
BID No: 27-1005 Catawba County Government Center Attn: Purchasing Department Post Office Box 389 Newton, North Carolina 28658	BID No: 27-1005 Catawba County Government Center Attn: Purchasing Department 25 Government Drive Newton, North Carolina 28658

All bids must be accompanied by a certified or cashier's check or original bid bond in the amount of five percent (5%) of the total base bid amount made payable to Catawba County.

A Performance Bond and Labor and Materials Payment bond, each in the amount equal to 100% of the Contract Sum, will be required to be furnished at the execution of the Contract Documents.

For all further requirements regarding bid submittal, qualifications, procedures, and contract award, refer to the Instructions to Bidders that are included in the Bidding Documents. All bidders are hereby notified that they must be properly licensed under the state laws governing their prospective trades. Bidders are also notified that applicable provisions of Chapter 87 of the General Statutes of the State of North Carolina shall be observed in the receiving of bids and awarding of contracts for the Work.

Project shall be completed within 240 Calendar Days after issuance of a Notice to Proceed.

Catawba County reserves the right to reject any and all bids and to waive informalities as may be permitted by law.

The County reserves the right to postpone bid openings for its own convenience. Please check the designated County website for details.

END OF ADVERTISEMENT FOR BIDS

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

MODIFIED INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACTS

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly by

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Associated General Contractors of America
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ASCE American Society of Civil Engineers

PE National Society of Professional Engineers
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TABLE OF CONTENTS

Page

Article 1 – Defined Terms 1
Article 2 – Copies of Bidding Documents 1
Article 3 – Qualifications of Bidders 1
Article 4 – Examination of Bidding Documents, Other Related Data, and Site Conditions 2
Article 5 – Bidder's Representations 3
Article 6 – Pre-Bid Conference 5
Article 7 – Site and Other Areas 5
Article 8 – Interpretations and Addenda 5
Article 9 – Bid Security 5
Article 10 – Contract Times 6
Article 11 – Liquidated Damages 6
Article 12 – Substitute and "Or-Equal" Items 6
Article 13 – Subcontractors, Suppliers and Others 6
Article 14 – Preparation of Bid 7
Article 15 – Basis of Bid; Comparison of Bids 8
Article 16 – Submittal of Bid 8
Article 17 – Modification and Withdrawal of Bid 9
Article 18 – Opening of Bids 10
Article 19 – Bids to Remain Subject to Acceptance 10
Article 20 – Evaluation of Bids and Award of Contract 10
Article 21 – Contract Security and Insurance 11
Article 22 – Signing of Agreement 11
Article 23 – Retainage 11
Article 24 – Commencement of Work 11
Article 25 – Prequalification of Equipment Suppliers 11

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ARTICLE 1 – DEFINED TERMS

1.01 Terms used in these Modified Instructions to Bidders have the meanings indicated below:

A. *Issuing Office* – The office from which the Contract Documents are to be issued and where the bidding procedures are to be administered.

B. *Unbalanced Bid* - An unbalanced bid is one that is either:

1. A mathematically unbalanced Bid is one that contains lump sum or unit bid items that do not appear to reflect reasonable actual costs. Reasonable actual costs include a reasonable proportionate share of the Bidder's anticipated profit, overhead costs, and other indirect costs the Bidder anticipates for the required performance; or

2. A materially unbalanced Bid is one that produces a reasonable doubt that Award to the low Bidder, who submitted the mathematically unbalanced Bid, would result in the lowest ultimate cost to the Owner.

C. *Responsible Bidder* - A bidder who has demonstrated the attribute of trustworthiness, as well as quality, fitness, capacity, and experience to satisfactorily perform the work described in the Contract Documents.

ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents may be obtained from the Issuing Office as stated in the advertisement or invitation to bid.

2.02 Complete sets of Bidding Documents must be used in preparing Bids. Neither the Owner nor the Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

ARTICLE 3 – QUALIFICATIONS OF BIDDERS

3.01 The Owner may make investigations to determine the qualifications of the Bidder to perform the work and the Bidder must furnish to the Owner all information and data requested. The Owner reserves the right to reject any Bid if the evidence submitted by, or investigation of, the Bidder fails to satisfy the Owner the Bidder is properly qualified to carry out the obligations of the contract, and to complete the work. Conditional bids will not be accepted.

3.02 Bidders must comply with all applicable laws regulating the practice of General Contracting as provided in Chapter 87 of the General Statutes of the State of North Carolina and be properly licensed as a contractor with the State of North Carolina.

3.03 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.

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3.04 Bidder must hold a current North Carolina contractor's license appropriate for the type and magnitude of the work.

ARTICLE 4 – EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE CONDITIONS

4.01 *Site and Other Areas*

The Site is identified in the Bidding Documents. By definition, the Site may include rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

4.02 *Existing Site Conditions*

A. Subsurface and Physical Conditions; Hazardous Environmental Conditions

1. The Bidding Documents identify:

   a. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site.

   b. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

   c. reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.

   d. Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are <u>not</u> part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the *Contract Documents.*

3. Geotechnical Report: The Bidding Documents may contain a Geotechnical Report. If included, the Geotechnical Report describes certain select subsurface conditions that are anticipated to be encountered by Contractor during construction in specified locations. The Geotechnical Report is a Contract Document.

   a. The conditions described in the Geotechnical Report are intended to reduce uncertainty and the degree of contingency in submitted Bids. However, Bidders cannot rely solely on the conditions described. Bids should be based on a comprehensive approach that includes an independent review and analysis of the Geotechnical Report, all other Contract Documents, Technical Data, other available information, and observable surface conditions. Not all potential subsurface conditions are described in the Geotechnical Report.

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b. Nothing in the Geotechnical Report is intended to relieve Bidders of the responsibility to make their own determinations regarding construction costs, bidding strategies, and Bid prices, nor of the responsibility to select and be responsible for the means, methods, techniques, sequences, and procedures of construction, and for safety precautions and programs incident thereto.

B. Underground Facilities: Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site are set forth in the Contract Documents and are based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

4.03 *Site Visit and Testing by Bidders*

A. Bidder must conduct Site visits during normal working hours and must not disturb any ongoing operations at the Site. The Owner requires site visits by the Bidder to be scheduled with the Owner in advance.

B. The Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions. However, on request, and to the extent the Owner has control over the Site, and schedule permitting, the Owner will provide Bidder access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site.

C. Bidder must comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs and regulations.

D. Bidder must fill all holes and clean up and restore the Site to its former condition upon completion of any explorations, investigations, tests, and studies.

4.04 *Owner's Safety Program*

A. Site visits and work at the Site may be governed by an Owner's Safety Program. As the General Conditions indicate, Bidders are responsible for complying with Owner's Safety Program, if any.

ARTICLE 5 – BIDDER'S REPRESENTATIONS

5.01 It is the responsibility of each Bidder before submitting a Bid, a Bidder is required to:

A. examine and carefully study the Bidding Documents, and the other related data identified in the Bidding Documents;

B. visit the Site and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

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C. become familiar with and satisfy itself as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work;

D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site including Underground Facilities that may be made available by the Owner and (2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in the Contract Documents.

E. consider the information known to Bidder; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents; and (3) Bidder's safety precautions and programs;

F. agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;

G. become aware of the general nature of any work that may be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder; and

I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.

5.02 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder, and that the Bidding Documents are sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

5.03 No verbal agreement or conversation with any officer, agent or employee of the Owner, either before or after the execution of the Contract, shall affect or modify any of the terms or obligations therein.

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ARTICLE 6 – PRE-BID CONFERENCE

6.01 A mandatory pre-bid conference will be held at 10:00 AM local time on October 8, 2026, at the Blackburn Resource Recovery Facility, 4017 Rocky Ford Road, Newton, North Carolina 28658.

ARTICLE 7 – SITE AND OTHER AREAS

7.01 The Site is identified in the Contract Documents. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Bidding Documents. All additional lands, and access thereto, required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor.

ARTICLE 8 – INTERPRETATIONS AND ADDENDA

8.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to the Owner in writing. Interpretations or clarifications considered necessary by the Owner in response to questions will be issued by Addenda delivered by electronic means to all parties recorded by the Engineer as having received the Bidding Documents. Questions received after 5:00 p.m., October 15, 2026, may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect. Contractor waives the right to rely on information provided by the Owner which is not provided in writing and in the form of a formal Addendum.

8.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner or Engineer.

8.03 Failure of any Bidder to receive any Addenda shall not relieve the Bidder from any obligation under the Bid as submitted.

8.04 All Addenda are incorporated into and a part of the Contract Documents.

ARTICLE 9 – BID SECURITY

9.01 A Bid must be accompanied by Bid security made payable to the Owner in an amount of **five percent (5%)** of Bidder's maximum Bid price and in the form of a certified check, bank money order, or a Bid bond (on the form included or the standard form of the surety company) issued by a surety meeting the requirements of the General Conditions.

9.02 The Bid security of the apparent Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned as necessary. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within ten (10) days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults. The Bid security of all other Bidders may be retained by Owner until the earlier of ten (10) days after the Effective Date of the

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Agreement or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned as necessary.

ARTICLE 10 – CONTRACT TIMES

10.01 The number of calendar days within which Milestones are to be achieved and the Work is to be substantially completed and ready for final payment are set forth in the Agreement.

ARTICLE 11 – LIQUIDATED DAMAGES

11.01 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 12 – SUBSTITUTE AND "OR-EQUAL" ITEMS

12.01 The Contract for the Work, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or "or-equal" items. Whenever it is specified or described in the Bidding Documents that a substitute or "or-equal" item of material or equipment may be furnished or used by Contractor if acceptable to Engineer, application for such acceptance will not be considered by Engineer until after the Effective Date of the Agreement.

12.02 All prices that Bidder sets forth in its Bid must be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

ARTICLE 13 – SUBCONTRACTORS, SUPPLIERS AND OTHERS

13.01 The Contract Documents may require the identification of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five (5) days after Bid opening, submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which identification is required. The list must be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each Subcontractor, Supplier, individual, or entity if requested by Owner. If Owner or Engineer, after investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute. If this occurs Successful Bidder must submit an acceptable substitute, and Bidder's Bid price will be increased (or decreased) by the difference in cost related to the substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

13.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so

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listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to revocation of such acceptance after the Effective Date of the Agreement as provided in the *Contract Documents*.

13.03 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.

ARTICLE 14 – PREPARATION OF BID

14.01 Only the Bid Form included with the Bidding Documents may be used and cannot not be altered, contain any unauthorized additions, deletions, or conditional bids.

14.02 The Bidder must not add any provision reserving the right to accept or reject an award, or to enter into a Contract pursuant to an award.

14.03 The Bid must not contain irregularities of any kind which make the Bid incomplete, indefinite, or ambiguous as to its meaning.

14.04 All blanks on the Bid Form must be completed in ink and the Bid Form signed in ink. Erasures or alterations must be initialed in ink by the person signing the Bid Form. A Bid price must be indicated for each section, Bid item, alternate, and unit price item listed therein. Alternative Bids will not be considered unless specifically shown on the Bid Form. In the case of optional alternatives the words "No Bid," "No Change," or "Not Applicable" may be entered.

14.05 A Bid by a corporation must be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate seal must be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation must be shown.

14.06 A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership must be shown.

14.07 A Bid by a limited liability company must be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown.

14.08 A Bid by an individual must show the Bidder's name and official address and be signed by the individual.

14.09 A Bid by a joint venture must be executed by each of the joint venturers in the manner indicated on the Bid Form. The official address of the joint venture must be shown.

14.10 All names must be printed in ink below the signatures**.**

14.11 The Bid must contain an acknowledgment of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.

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14.12 Street, postal and e-mail addresses and telephone numbers for communications regarding the Bid must be shown.

14.13 The Bid must contain evidence of Bidder's authority and qualification to do business in the State of North Carolina, or Bidder must agree in writing to obtain such authority and qualification prior to award of the Contract and attach to the Bid.

14.14 Bidder's NC state contractor license number must be shown on the Bid Form.

14.15 All attachments, certifications or acknowledgements attached to the Bid must be executed in the same manner as the Bid.

ARTICLE 15 – BASIS OF BID; COMPARISON OF BIDS

15.01 *Lump Sum*

Bidders must submit a Bid on a lump sum basis as set forth in the Bid Form.

15.02 *Base Bid with Alternates*

Bidders must submit a Bid for the base Bid as shown on the Bid Form and include a separate price for each alternate described in the Bidding Documents and as provided for in the Bid Schedule. The price for each alternate will be the amount added to or deleted from the base Bid if Owner selects the alternate.

15.03 *Unit Price*

A. Bidders must submit a Bid on a unit price basis for each item of Work listed in the Bid Schedule.

B. The total of all estimated prices will be the sum of the products of the estimated quantity of each item and the corresponding unit price. The final quantities and Contract Price will be determined in accordance with the *Bidding Documents*.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

15.04 Bids will be compared on the basis of the totals of the lump sum and/or unit prices bid. The resulting Total Contract Bid Price will be compared which must include and cover the furnishing of all materials, and the performance of all labor requisite for proper completion of all the work called for under the accompanying Contract, and in the manner set forth and described in the Contract Documents.

15.05 The lowest Bidder will be the Bidder whose Bid totals the lowest number of dollars as determined above.

ARTICLE 16 – SUBMITTAL OF BID

16.01 The Bid Form in the Bidding Documents must be completed and submitted.

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16.02 A Bid must be received no later than the time and date prescribed and at the place indicated in the advertisement or invitation for bids. The bid must be submitted in a single (one (1)) envelope system. The envelope must be plainly marked with the Project title, Owners name and address in the middle of the envelope and the name, address, license number, limitation and classification of Bidder in the upper left hand corner of the envelope. The envelope must contain the Bid and any other required information as defined in the advertisement or invitation for bid or bid documents.

16.03 If a Bid is sent by mail or other delivery system, the envelope containing the Bid must be plainly marked on the outside with the notation "BID ENCLOSED for Blackburn Resource Recovery Facility's New Operator's Building." For U.S. Postal Service, a Bid must be addressed to:

Tina Wright
Catawba County Purchasing Manager
P.O. Box 389
Newton, North Carolina 28658

For delivery via other methods, a Bid must be addressed to:

Tina Wright
Catawba County Purchasing Manager
25 Government Drive
Newton, North Carolina 28658

16.04 If received prior to the designated time of opening, bids will be securely kept. Mailed bids will be treated in every respect as though filed in person and will be subject to the same requirements. Bids received subsequent to the designated time of opening will be returned to the Bidder unopened.

ARTICLE 17 – MODIFICATION AND WITHDRAWAL OF BID

17.01 A Bid may be withdrawn prior to the Bid opening by the Bidder by providing an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

17.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 17.01 and submit a new Bid prior to the date and time for the opening of Bids.

17.03 No Bid may be withdrawn for a period of 90 days after Bids have been opened pending the execution of a Contract with the successful bidder except as provided for in Section 143-129.1 of the North Carolina General Statutes. A Bidder must file a duly signed written notice within the time frame allowed under applicable statutes with the Owner and Engineer promptly after the time set for the opening of bids that demonstrates, to the reasonable satisfaction of Owner, there was a material and substantial mistake in the preparation of its Bid, and the Bidder desires to withdraw its Bid. The Owner and Engineer will review the request and, if approved, the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

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ARTICLE 18 – OPENING OF BIDS

18.01 Bids will be opened at the time and place indicated in the Advertisement for Bids and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of the Bids.

ARTICLE 19 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE

19.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid prior to the end of this period.

ARTICLE 20 – EVALUATION OF BIDS AND AWARD OF CONTRACT

20.01 Owner reserves the right to select any or none of the Add Alternates included in the Bid Schedule.

20.02 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids if there is a reasonable doubt the bid will result in the lowest overall cost to the Owner even though it may be the low evaluated bid, or if it is so unbalanced as to be tantamount to allowing an advanced payment.

20.03 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, the Owner will reject the Bid as nonresponsive; However, Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.

20.04 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

20.05 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

20.06 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

20.07 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work in accordance with the Contract Documents.

20.08 If Owner awards the contract for the Work, such award shall be to the responsible Bidder submitting the lowest responsive Bid including any selected Add Alternatives.

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ARTICLE 21 – CONTRACT SECURITY AND INSURANCE

21.01 The *Bidding Documents* sets forth the Owner's requirements as to performance and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by the insurance documentation.

ARTICLE 22 – SIGNING OF AGREEMENT

22.01 When Owner issues a Notice of Award to the Successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Agreement along with the other Contract Documents which are identified in the Agreement as attached thereto. Within 10 days thereafter, Successful Bidder must sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. The Owner will set a time and place for a Preconstruction conference. One fully signed counterpart of the Contract Documents will be provided to the Contractor following review from the Owner's legal counsel.

ARTICLE 23 – RETAINAGE

23.01 Provisions concerning Contractor's rights to deposit securities in-lieu of retainage are set forth in the Agreement.

ARTICLE 24 – COMMENCEMENT OF WORK

24.01 Upon execution and delivery of the Contract and insurance certificates and policies by the Contractor to the Owner, the Contractor will be notified to proceed with the work of the Contract. The work of the Contract must be commenced within ten (10) days following such notification or as otherwise specified in the Notice to Proceed.

24.02 The Contractor must notify the Engineer, in writing, of its intention to enter upon the site of the work at least three (3) days in advance of such entrance.

ARTICLE 25 – PREQUALIFICATION OF EQUIPMENT SUPPLIERS

25.01 Certain equipment on this project may require the prequalification of manufacturers prior to the receipt of bids. When required by the Contract Documents, manufacturers wishing to supply equipment for this project must submit a prequalification submittal to the Engineer for approval. The prequalification submittal must be submitted by the equipment manufacturer and received by the Engineer by the specified time listed in the Contract Documents to receive consideration. The submittal must demonstrate the proposed equipment meets the requirements of the Contract Specifications and Drawings. The Engineer will issue an addendum prior to the bid date listing the approved manufacturers.

25.02 The submittal of prequalification information does not omit the requirement for the Contractor and manufacturers to submit complete shop drawing submittals to the Engineer in accordance with the Contract Documents.

25.03 The prequalification submittal must be made a minimum of 14 days prior to the bid date.

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25.04 The naming of manufacturers in the technical specifications is given as a basis for comparison and does not omit the requirement for the Contractor and manufacturers to provide a prequalification submittal.

25.05 The manufacturer is responsible for visiting the site prior to the bid. Failure to visit the site to understand all existing facility, operation, and site conditions does not relieve the manufacturer from complying with all of the requirements of the Contract Documents and specifications.

25.06 Refer to the individual equipment specifications for prequalification requirements.

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PARTICPATION BY MINORITY BUSINESSES

Blackburn Resource Recovery Facility Operator's Building
Catawba County, North Carolina

Project # 26.00701
Bid # 25-1023

All bidders are notified that Catawba County has a verifiable five percent (5%) goal for participation by minority-owned, women-owned, and disadvantaged-owned businesses in the total value of Work for which prime contractors are awarded pursuant to North Carolina General Statutes Section 143-128. Please see Catawba County's Minority-owned, Women-owned, Disadvantaged-owned Outreach Plan included in these bid documents with Addendum No. 1.

NOTE: The bidder shall include with the bid proposal the form *Identification of Minority Business Participation* identifying the minority business participation it will use on the project and shall include either *Affidavit A – Listing of Good Faith Efforts* or *Affidavit B – Intent to Perform Contract with Own Workforce* as applicable. Forms and instructions are included within these bid documents. Failure to complete these forms is grounds for rejection of the bid.

BID FORM

Blackburn Resource Recovery Facility
Operator's Building
Catawba County, North Carolina

Project # 26.00701
Bid # 27-1005

TABLE OF CONTENTS

Article No.	Page No.
Article 1 - Bid Recipient	2
Article 2 - Bidder's Acknowledgements	2
Article 3 - Bidder's Representations	2
Article 4 - Further Representations	3
Article 5 - Basis of Bid	4
Article 6 - Time of Completion	5
Article 7 - Attachments to this Bid	5
Article 8 - Bid Submittal	6

ARTICLE 1 – BID RECIPIENT

This Bid is submitted to:

Tina Wright, Purchasing Manager
Catawba County
25 Government Drive
Newton, North Carolina 28658

The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for **90** days after the date of the Bid opening, or for such longer period of time Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents:

A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged.

Addendum No.	Addendum Date
_____	_____
_____	_____
_____	_____;

B. Bidder has visited the Project Site and become familiar and is satisfied with local and Site conditions that may affect cost, progress, and performance of the Work;

C. Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress and performance of the Work;

D. Bidder has carefully studied all: reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures, including Underground Facilities, at or contiguous to the Site which have been included as a part of the Contract Documents;

E. Bidder has obtained and carefully studied (or accepts the consequences for not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents to be employed by Bidder, and safety precautions and programs incident thereto;

F. Bidder does not consider any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid, within the times, and in accordance with the other terms and conditions of the Bidding Documents;

G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

H. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;

I. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder or, if no written response was made by Engineer, Bidder has resolved the issue to its satisfaction prior to the submittal of its Bid;

J. The Bidding Documents are sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which the Bid is submitted;

K. Bidder will submit written evidence of its authority to do business in North Carolina not later than the date of its execution of the Agreement;

L. Bidder has not relied upon any information provided by the Engineer except information which is part of the Bidding Documents, is in writing and in the form of a formal addendum and

M. The submission of a Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of the Bid Documents and the Instructions to Bidders, and without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents.

ARTICLE 4 – FURTHER REPRESENTATIONS

4.01 Bidder further represents:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

ARTICLE 5 – BASIS OF BID

Bidder will complete the Work in accordance with the Contract Documents for the prices listed in the attached Bid Schedule.

UNIT PRICE BID

See attached Bid Schedule

Bidder acknowledges estimated quantities are not guaranteed and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder agrees the Work will be substantially complete within 210 calendar days after the date when the Contract Times commence to run as provided in the *Contract Documents*, and will be completed and ready for final payment 240 calendar days after the date when the Contract Times commence to run.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the Contract Times.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are attached to, incorporated herein by reference, and made a condition of this Bid:

A. Required Bid Security

B. List of Proposed Subcontractors

C. Evidence of Authority to do Business in the State of the Project

D. Contractor's License Number as Evidence of Bidder's State Contractor's License

E. Completed Bid Schedule

F. Non-Collusive Affidavit

ARTICLE 8 – BID SUBMITTAL

This Bid Submitted By:

If Bidder is:

An Individual

Name (typed or printed): _____

By: _____ (SEAL)
(Individual's signature)

Doing business as: _____

A Partnership

Partnership Name: _____ (SEAL)

By: _____
(Signature of general partner -- attach evidence of authority to sign)

Name (typed or printed): _____

A Corporation

Corporation Name: _____ (SEAL)

State of Incorporation: _____
Type (General Business, Professional, Service, Limited Liability): _____

By: _____
(Signature -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____ (CORPORATE SEAL)

Attest _____

Date of Authorization to do business in *[North Carolina]* is _____

A Joint Venture

Name of Joint Venture: _____

First Joint Venturer Name: _____ (SEAL)

By: _____
(Signature of first joint venture partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Second Joint Venturer Name: _____ (SEAL)

By: _____
(Signature of second joint venture partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

(Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.)

Bidder's Business Address _____

_____

Phone No. _____ Fax No. _____

SUBMITTED on _____, 20____.

State Contractor License No. _____.

BID SCHEDULE

ITEM #	DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL AMOUNT
SECTION A - BASE BID					
1	Mobilization/General Requirements	1	LS		
2	Demolition	1	LS		
3	Erosion Control	1	LS		
4	Earthwork	1	LS		
5	Concrete Sidewalk - 4"	175	SY		
6	Heavy Duty Asphalt Paving	590	SY		
7	Concrete Paving - 6"	34	SY		
8	Striping & Signage	1	LS		
9	Angle Wheel Stops	42	LF		
10	Tie-in to Existing Water Line	1	LS		
11	PVC Water Line	26	LF		
12	Tie-in to Existing Manhole	1	LS		
13	SCH 40 PVC Sewer Line	101	LF		
14	Sewer Cleanouts	2	EA		
15	Rip Rap Outlet	1	LS		
16	Precast Concrete Endwall	1	LS		
17	12" HDPE Pipe	53	LF		
18	8" Trench Drain	46	LF		
19	4" HDPE Pipe	126	LF		
20	Storm Structures	2	EA		
21	Operator's Building	1	LS		
22	Undercut Excavation	75	CY		
23	Washed Stone	100	Tons		
24	Landscaping	1	LS		
				TOTAL BID	

Non-Collusive Affidavit
(Submit with Bid Documents)

State of_____

County of _____

_____ being first duly sworn, deposes and says that:

(1) He/She is the _____, (Owner, Partner, Officer, Representative or Agent) of _____ the Bidder that has submitted the attached Bid;

(2) He/She is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid;

(3) Such Bid is genuine and is not a collusive or sham Bid; employees or parties in interest, including this affiant, have in any way colluded, conspired, connived or agreed, directly or indirectly, with any other Bidder, firm, or person to submit a collusive or sham Bid in connection with the Work for which the attached Bid has been submitted; or to refrain from bidding in connection with such Work; or have in any manner, directly or indirectly, sought by agreement or collusion, or communication, or conference with any Bidder, firm, or person to fix the price or prices in the attached Bid or of any other Bidder, or to fix any overhead, profit, or cost elements of the Bid price or the Bid price of any other Bidder, or to secure through any collusion, conspiracy, connivance, or unlawful agreement any advantage against(Recipient), or any person interested in the proposed Work;

(4.) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance, or unlawful agreement on the part of the Bidder or any other of its agents, representatives, owners, employees or parties in interest, including this affidavit/.

BY_____

ITS_____

(Title)

Subscribed and sworn to before me

This _____ day of _____

_____

_____

My Commission Expires _____

NOTICE OF AWARD

Date: _____

Project: Blackburn Resource Recovery Facility Operator's Building	
Owner: Catawba County	Bid No.: 27-1005
Contract: Blackburn Resource Recovery Facility Operator's Building	Engineer's Project No.: 26.00701
Bidder:	
Bidder's Address:	

You are notified that your Bid dated _____, for the above Contract has been considered. You are the Successful Bidder and are awarded a Contract for Blackburn Resource Recovery Facility Operator's Building.

The Contract Price of your Contract is ().

Four (4) copies of the proposed Contract Documents (except Drawings) accompany this Notice of Award.

You must comply with the following conditions precedent within ten (10) days of the date you receive this Notice of Award.

1. Deliver to the Owner [Four (4)] fully executed counterparts of the Contract Documents.
2. Deliver with the executed Contract Documents the Contract security [Bonds] and other documents as specified.

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Contract Documents.

Catawba County
Owner

By: _____
Authorized Signature

_____
Title

ACCEPTED

_____
Contractor
By: _____
Authorized Signature

_____
Title

CONSTRUCTION CONTRACT
FOR
BLACKBURN RESOURCE RECOVERY FACILITY OPERATOR'S BUILDING

THIS AGREEMENT made as of the ___ day of _____, 2026, by and between Catawba County, a body politic and a political subdivision of the State of North Carolina, (hereinafter "County") and _____, a corporation, (hereinafter "Contractor"). County and Contractor are referred to herein each as a "Party" and collectively as the "Parties".

Project: Blackburn Resource Recovery Facility Operator's Building

Owner:
Catawba County
Attn: Mary Furtado
25 Government Drive
Newton, North Carolina 28658

Contractor:
_____
_____
_____
_____

NCGC License #_____
Qualifier Name: _____

WITNESSETH:

Contractor and County, in consideration of the mutual covenants and agreements herein contained, agree as follows:

1. SCOPE OF WORK: Contractor shall furnish and deliver all of the materials and perform all of the work described in the Contract Documents ("Work"), except as specifically indicated in the Contract Documents to be the responsibility of others. The work is generally described as follows:

   SITE PREPARATION AND CONSTRUCTION OF AN APPROXIMATELY 2,020 SQUARE FOOT METAL FRAME BUILDING TO BE USED BY THE BRRF'S ON-SITE OPERATORS. THE SITE WORK WILL INCLUDE DEMOLITION OF EXISTING PAVEMENT AND SELECT SITE FEATURES, LIGHT GRADING FOR THE BUILDING PAD, A CONCRETE SIDEWALK SURROUNDING THE NEW BUILDING, AND HEAVY DUTY ASPHALT PAVEMENT FOR THE NEW PARKING AND DRIVEWAY AREAS. THE BUILDING ITSELF INCLUDES TWO VESTIBULE ENTRANCES, A LOCKER SPACE, A LARGE OPEN TRAINING AND GATHERING AREA WITH A KITCHENETTE, TWO RESTROOMS, A STORAGE CLOSET, AND A MECHANICAL CLOSET.

   The Construction Agreement ("hereinafter Agreement") consists of the Contract Documents which includes this Contract, the General Conditions of the Construction Contract, Specifications, Plans or Drawings, any Addenda issued prior to execution of this Contract or other documents listed in this Contract or incorporated herein by reference, and any Modifications executed by the Parties after execution of this Contract, all of which form the Agreement, and are as fully a part of this Agreement as if attached to this Contract or repeated herein. The Agreement represents the entire and integrated agreement between the Parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract Documents consist of this Contract and the following:

1. General Conditions to Construction Contract, attached as Exhibit A
2. Project Manual bearing the general title "Blackburn Resource Recovery Facility Operator's Building" dated September 2026 ("Specifications")
3. Drawings bearing the general title "Catawba County Landfill New Operator's Building" ("Plans")
4. Addenda numbers [_] to [_], inclusive.
5. Completed Bid Form, attached as Exhibit B ("Bid")
6. Certification of Insurance, attached as Exhibit C ("COI")
7. Change Orders or Modifications Subsequently Executed by the Parties ("Modifications").

2. TIME OF COMPLETION: The Contractor shall commence Work to be performed under this Agreement on or about _____, _____ and shall fully complete all work hereunder on or before _____, _____, or within approximately Two Hundred Forty (240) consecutive calendar days from issuance of the Notice to Proceed ("Time of Completion"). "Substantial Completion" as used herein shall have the meaning assigned to it in Exhibit A, attached.

   Where Contractor is prevented from completing any part of the Work within the Time of Completion due to delay beyond the control of Contractor, the Time of Completion may be extended in an amount equal to the time lost due to the delay if a Claim is made as provided in Section 4.2 of the of the General Conditions and if the performance of the Work is not, was not, or would not have been delayed by any other cause for which the Contractor is not entitled to an extension of the Time of Completion under the Contract Documents. Delays beyond the control of Contractor include, but are not limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work, fires, floods, epidemics, abnormal weather conditions, or acts of God. Contractor acknowledges and agrees that adjustments in the Time of Completion will be permitted for a delay only to the extent such delay (i) is not caused, or could not have been anticipated, by Contractor; (ii) could not be limited or avoided by the Contractor's timely notice to Owner of the delay or reasonable likelihood that a delay will occur; and (iii) is of a duration not less than one day. In no event will claims for delay be allowed where alleged delays do not impact the critical path of the Contractor as demonstrated on the relevant schedule provided by the Contractor for the period of time in which the delay allegedly occurred.

   If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, supply chain disruptions, material or labor shortages, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor is entitled to an equitable adjustment in Time of Completion, if the adjustment is essential to Contractor's ability to complete the Work within the Time of Completion. An adjustment in the Time of Completion is Contractor's sole and exclusive remedy for the delays described in this Section.

   Furthermore, to the fullest extent permitted by law, and notwithstanding anything to the contrary in the Contract Documents, an extension of the Time of Completion pursuant to Section 8.3 of the General Conditions, shall be the sole remedy of Contractor for any (i) delay in the commencement, prosecution, or completion of the Work, (ii) hindrance or obstruction in the performance of the Work, (iii) loss of productivity, or (iv) other similar claims (collectively referred to in this Section as "Delays") whether or not such Delays are foreseeable, unless a Delay is caused by acts of Owner constituting active interference with

Contractor's performance of the Work, and only to the extent such acts continue after Contractor furnishes Owner with notice of such interference. In no event shall Contractor be entitled to any compensation with any Delay, including, without limitation, consequential damages, lost opportunity costs, impact damages, or other similar remuneration. Owner's exercise of any of its rights under the Contract Documents (including, without limitation, ordering changes in the Work, or directing suspension, rescheduling, or correction of the Work), regardless of the extent or frequency of Owner's exercise of such rights or remedies, shall not be construed as active interference with Contractor's performance of the Work.

If the Time of Completion is not adjusted, then for each day in excess of the Time of Completion in which the Work is not complete, the Contractor shall pay the Owner the amount of Five Hundred Dollars ($500.00) as liquidated damages, the rate of which is reasonably estimated and mutually agreed upon in advance, to cover the losses to be incurred by the Owner should the Contractor fail to complete the Work within the time specified.

3. CONTRACT ADMINISTRATION: McGill Associates, PA shall serve as the Contract Administrator for this Project.

Owner's Point of Contact for Project:	Rodney Hamby, Landfill Superintendent
Contractor's Point of Contact for Project:	[Insert Name/ Proj. Superintendent]
This Project was designed by:	McGill Associates, PA 55 Broad Street, Asheville, NC 28801

4. CONTRACT SUM: The Contract Sum is for an amount not to exceed _____ ($_____.00). The Contractor agrees to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the construction of the above titled Project in full and complete accordance with the plans, specifications and Contract Documents to the full and entire satisfaction of Catawba County with a definite understanding that no money will be allowed for extra work without written consent of the Owner.

5. PAYMENT:
   A. Submittal and Processing of Payments. Contractor shall submit Applications for Payment in accordance with Article 9 of the General Conditions. Applications for Payment will be processed by Designer as provided in the General Conditions.
   B. Progress Payments; Retainage. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the 30th day of each month during performance of the Work as provided below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.
      1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to Liquidated Damages, in accordance with the Contract.

a. 95 percent of the value of the Work completed (with the balance being retainage).
b. 95 percent of cost of materials (excluding soil) and equipment not incorporated in the Work but delivered and suitable stored (with the balance being retainage).

2. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 100 percent of the Work completed, less Retainage as provided in Paragraph 9.4, such amounts set off by Owner as Liquidated Damages, and less 200 percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

C. Final Payment. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price less any such amounts set off by Owner as Liquidated Damages.

D. Consent of Surety. Notwithstanding the foregoing, Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the Surety to such payment, return, or release.

6. PAYMENT BOND: The Contractor is required to submit a Payment Bond in the amount of 100% of the Contract Sum, conditioned upon the prompt payment for all labor or materials for which Contractor or a subcontractor is liable.

7. PERFORMANCE BOND: The Contractor is required to submit a Performance Bond in the amount of 100% of the Contract Sum, conditioned upon the faithful performance of this Agreement in accordance with the Plans, Specifications and conditions of the Bid and Contract Documents.

8. CONTRACTOR REPRESENTATIONS: In order to induce Owner to enter into this Contract, Contractor makes the following representations:

A. Contractor has examined and carefully studied the Contract Documents, including Addenda.

B. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site with respect to the Technical Data in such reports and drawings, if any.

E. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site.

F. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.

G. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
H. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
I. Contractor has given Contract Administrator written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
J. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
K. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

9. CONTRACTOR'S CERTIFICATIONS: Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 10:
   A. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;
   B. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
   C. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and
   D. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

10. NOTICES: Any notice required by this Agreement shall be in writing and delivered by certified or registered mail, return receipt requested to the following:

Owner:	**Contractor:**	**Engineer:**
Catawba County	[Name]	McGill Associates, PA
Attn: Landfill Superintendent	Attn: [POC]	Attn: Scott Burwell, PE
25 Government Drive	[Address]	55 Broad Street
Post Office Box 389		Asheville, NC 28801
Newton, North Carolina 28658		

11. UTILITIES: Owner may provide certain utilities such as power or water, with connections and extensions by the Contractor.

12. ACCESS CONTROL: Owner will provide Contractor access to the Project site as reasonably necessary to perform the Work. The Contractor will be issued construction badges that will allow access to building / departments. These badges will be required to be turned back in to Owner before final payment is issued.

13. LANDFILL SUPERINTENDENT: The Contractor's Point of Contact ("POC") for this Project is the Catawba County Landfill Superintendent, Rodney Hamby, (828) 312-1672. Any questions regarding the Project shall be directed to him.

14. HOURS OF OPERATION: The normal hours of operation are Monday through Friday, 8:00 a.m. to 5:00 p.m. If Contractor anticipates working outside of those normal hours for any reason, Contractor must coordinate that with the Catawba County Landfill Superintendent, Rodney Hamby, (828) 312-1672.

15. NO SMOKING POLICY: All Catawba County grounds and buildings are smoke and tobacco free. During the performance of the Work under this Agreement, Contractor agrees to enforce this policy and to require all employees and any subcontractors or material providers to abide by this policy when on County property.

16. E-VERIFY: Contractor shall comply with the requirements of Article 2 of Chapter 64 of the North Carolina General Statutes. Further, if Contractor utilizes a subcontractor, Contractor shall require the subcontractor to comply with the requirements of Article 2 of Chapter 64 of the North Carolina Statutes.

17. TIME OF THE ESSENCE: Time is of the essence in the performance of this Agreement.

18. COMPLIANCE WITH LAWS: Contractor represents that it is qualified and possesses the necessary skill and experience to perform the Work under this Agreement and that it will complete the Work in compliance with all applicable laws, ordinances, codes, rules and regulations. Contractor shall comply with all laws, ordinances, codes, rules, regulations, and licensing requirements that are applicable to the conduct of its business, including those of federal, state, and local agencies having jurisdiction and/or authority, during the term of this Agreement.

19. WAIVER OF DEFAULT: Waiver by the County of any default or breach in compliance with the terms of this Agreement by Contractor shall not be deemed a waiver of any subsequent default or breach and shall not be construed to be a modification of the terms of this Agreement unless stated to be such in writing, signed by an authorized representative of the County and the Contractor and attached to the Agreement, and then only to the extent expressly stated.

20. CHOICE OF LAW: This Agreement shall be governed and construed in accordance with the laws of the State of North Carolina. Venue for any adversarial proceeding shall be set in Catawba County.

21. ENTIRE AGREEMENT: This Agreement constitutes the entire agreement and understanding between the Parties respecting the subjects covered herein, and shall not be modified in any respect except in a writing that is signed by both Parties. The Parties may enter into additional agreements to the extent they are not inconsistent with the terms hereof. In the event there is an inconsistency, the terms of this Agreement shall prevail.

22. EXECUTION: This Agreement may be executed electronically and in multiple counterparts, with each part so executed being deemed an original, however, collectively constituting but a single document.

23. HEADINGS: The Section and Paragraph headings in this Agreement are not material parts of the agreement and should not be used to construe the meaning thereof.

24. SEVERABILITY: In the event that a court of competent jurisdiction holds that a provision or requirement of this contract violates any applicable law, each such provision or requirement shall continue to be enforced to the extent it is not in violation of law or is not otherwise unenforceable and all other provisions and requirements of this contract shall remain in full force and effect.

25. FORCE MAJEURE: If Contractor's performance of Work is delayed by a force majeure, Contractor shall immediately, but in no case more than forty-eight (48) hours after such conditions become known, notify County of the delay, the reasons therefore and the anticipated duration of any such delay. Contractor's delay in the performance of services shall be excused during the duration of such force majeure, provided Notice was timely given under this Section.

26. INDEMNIFICATION: The Work to be performed by Contractor under this Agreement shall be performed entirely at Contractor's own risk. Contractor shall indemnify and save harmless the County, its commissioners, employees, agents and representatives from any and all liabilities and claims of every kind, including attorney's fees, to which County may be subjected on account of loss, destruction or damage to property or injury to or death of persons, including Contractor and persons employed by Contractor, arising out of or in connection with performance of this Agreement. The provisions of this paragraph shall not be applicable to loss or damage caused by the negligent act of omission of County or its employees.

27. INSURANCE: Contractor will carry and maintain, throughout the period of this Agreement, at Contractor's sole expense, professional and general liability insurance of no less than $1,000,000 per occurrence and $2,000,000 annual aggregate; and worker's compensation insurance providing statutory limit coverage, plus Employer's Liability coverage with limits of not less than $1,000,000 per accident and $1,000,000 for each employee for injury by disease. In addition, the workers' compensation policy must contain a waiver of subrogation in favor of the County. Defense costs shall be in excess of the limit of liability. Contractor shall also provide automobile insurance coverage, when applicable, for any owned, hired, or rented vehicle with a limit of not less than $1,000,000 per occurrence combined single limit for bodily injury and property damage liability and a limit of not less than $15,000 for medical payment coverage. If employees, agents or representatives of Contractor, including specifically independent contractors under contract to Contractor, transport County's clients in their personal vehicles, Contractor will ensure that any such transportation service is covered by insurance, whether it be the insurance of Contractor or of the vehicle owner, and that vehicles are maintained in a condition that imposes no apparent risk to the clients and/or to the public.

    Contractor shall maintain an occurrence basis (as distinguished from a "claims made" basis) Umbrella Liability policy (true follow form) over the underlying General Liability, Automobile Liability, and Employer's Liability, with the following limits of liability: Each Occurrence $5,000,000 / Aggregate $5,000,000.

Contractor shall maintain Property Insurance in the form of an "All Risk" or equivalent policy form equal to the value of the Contract including any Change Orders added during the life of the contract.

Catawba County shall be named as an additional insured under Contractor's automobile and general liability insurance company. In the event of a loss arising out of, or related to the Contractor's services performed under this Agreement, Contractor's Liability insurance shall be primary (pay first) with respect to any other insurance which may be available to the County, regardless of how the "other insurance" provisions may read.

Contractor has provided a Certificate of Insurance ("COI") which is attached hereto as Exhibit C. Contractor agrees to indemnify County if the insurance policy referenced in the COI does not contain, at a minimum, the coverage amounts listed on the COI. All insurance policies put forth to satisfy the above requirements shall require the insurer issuing the underlying policy to provide County with a minimum of thirty (30) days' notice prior to modification or cancellation of said policy. The maintenance of such insurance will not in any manner affect Contractor's obligation to indemnify County as described herein.

28. ASSIGNMENT: This Agreement or any right hereunder, shall not be assigned by either party, nor shall any duty hereunder be delegated by either party, without the express written consent of the other party. Any attempt at assignment or delegation without such consent shall be void.

29. INDEPENDENT CONTRACTOR: This Agreement does not constitute Contractor an employee, agent, representative, joint venture or partner of County for any purpose whatsoever. Contractor is not authorized to make any contract, agreement, warranty or representation, express or implied, on behalf of County. Neither Contractor nor any employee or agent of Contractor has an employment status with County and are not entitled to participate in any benefits extended by County to its own employees. All persons employed by Contractor to perform Services hereunder shall be subject to the exclusive direction and control of Contractor, it being the intention of the parties that Contractor and its employees shall remain independent contractors, not subject to the control of County.

30. SIGNATURE WARRANTY: The undersigned represent and warrant that they are authorized to bind their principals to the terms of this Agreement.

31. NON-DISCRIMINATION: Neither Party nor its employees will discriminate against any person based on race, religion, creed, color, sex, gender identity and expression, pregnancy, childbirth, breastfeeding, medical conditions related to pregnancy, childbirth, or breastfeeding, sexual orientation, marital status, age, national origin, ancestry, genetic information, disability, veteran status, low income status or any class protected by local, state, or federal law in the performance of this Agreement.

[Signatures begin on next page]

This Contract entered into as of the day and year first written above.

OWNER:

CATAWBA COUNTY

_____
Mary Furtado, County Manager

_____
Date

CONTRACTOR:

CONTRACTOR NAME HERE

_____
Name and Title

_____
Date

THIS INSTRUMENT has been pre-audited in the manner required by the Local Government Budget and Fiscal Control Act as amended.

Date: _____ _____
Mary Morrison, Chief Financial Officer
Account Number:
Amount:
Source: Federal ___ State ___ Local ___

APPROVED AS TO FORM

Date: _____ _____
Jodi Stewart, County Attorney

Date: _____ _____
Jake Robinson, Risk Management

Exhibit A
GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

ARTICLE 1 GENERAL PROVISIONS

1.1. BASIC DEFINITIONS

1.1.1 Contract for Construction (“Agreement”). The Contract Documents form the Agreement. The Agreement represents the entire and integrated agreement between the Parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Agreement may be amended or modified only by a Modification.

1.1.2 Contract Documents. The Contract Documents consist of the Contract between Owner and Contractor (hereinafter the Contract), Conditions of the Contract (General, Supplementary and other Conditions as applicable), Drawings, Specifications, Addenda issued prior to execution of the Contract, advertisement or invitation to bid, Instructions to Bidders, other documents listed in the Agreement and Modifications issued after execution of the Contract. In the event of conflicts among the contract documents, the Specifications shall take precedence over the Drawings, and the Supplementary Conditions (if provided) shall take precedence over the General Conditions. The Contract Documents shall not be construed to create a contractual relationship of any kind between the Owner and a Subcontractor or Sub-subcontractor.

1.1.3 Contractor. The person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. Unless otherwise stated, the term "Contractor" means the General Contractor or the General Contractor's authorized representative.

1.1.4 Drawings. The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

1.1.5 Designer. The Architect or Engineer registered in accordance with the provisions of Chapter 89C of the NC General Statutes, identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Designer" refers to the Designer or the Designer's authorized representative(s). The Designer shall be entitled to performance and enforcement of obligations under the Agreement intended to facilitate performance of the Designers’ duties.

1.1.6 Modification. A Modification is (1) a written amendment to the Contract signed by the parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Designer.

1.1.7 Owner. The person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Owner" means the Owner or the Owner's authorized representative.

1.1.8 Project. The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner or by separate contractors.

1.1.9 Project Manual. The Project Manual is the volume usually assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications.

1.1.10 Specifications. The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards and workmanship for the Work, and performance of related services.

1.1.11 Work. The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be

provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the project.

1.2 EXECUTION, CORRELATION, AND INTENT

1.2.1 The Contract Documents shall be signed by the Owner and Contractor as provided in the Agreement. If either the Owner or Contractor or both do not sign all the Contract Documents, the Designer shall identify such unsigned Documents and insure that they are properly signed by the necessary Parties.

1.2.2 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become familiar with local conditions under which the Work is to be performed, correlated personal observations with requirements of the Contract Documents, has checked and verified all site conditions, and hereby waives any and all claims, present or future, for misrepresentation on the part of the Owner or Designer.

1.2.3 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all.

1.2.4 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any Subcontractor.

1.2.5 Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

1.3 OWNERSHIP AND USE OF DESIGNER'S DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS. The Drawings, Specifications and other documents prepared by the Designer are instruments of the Designer's service through which the Work to be executed by the Contractor is described. The Contractor may retain one contract record set. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Designer. The Owner will retain all common law, statutory and other reserved rights, in addition to the copyright of the drawings, specifications and other documents prepared by the Designer. All copies of them, except the Contractor's record set, shall be returned or suitably accounted for to the Designer, on request, upon completion of the Work. The Drawings, Specifications and other documents prepared by the Designer, and copies thereof furnished to the Contractor, are for use solely with respect to this Project; they are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects without the specific written consent of the Owner and Designer. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Designer appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this license shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Designer. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Owner's copyright or other reserved rights.

1.4 CAPITALIZATION. Terms capitalized in these General Conditions include those which are (1) specifically defined, (2) the titles of numbered articles and identified references to Paragraphs, Subparagraphs and Clauses in the document or (3) the titles of other documents.

1.5 INTERPRETATION. In the interest of brevity, the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

ARTICLE 2 OWNER

2.1 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.1.1 The Owner shall furnish plans and profiles of existing County utilities. The Contractor is responsible for locating all existing utilities prior to Work.

2.1.2 Except for permits and fees which are the responsibility of the Contractor under the Contract Documents, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

2.1.3 Information or services under the Owner's control shall be furnished by the Owner with reasonable promptness to avoid delay in orderly progress of the Work.

2.1.4 Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, such copies of Drawings and Project Manuals as are reasonably necessary for execution of the Work.

2.2 OWNER'S RIGHT TO CARRY OUT THE WORK. If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may after such seven-day period, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Designer's additional services and expenses made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

3.1. REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.1.1 The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Owner pursuant to Section 2.1, and shall at once report to the Designer and to the Owner errors, inconsistencies or omissions discovered. If the Contractor performs any construction activity knowing, or where Contractor should have known, it involves an error, inconsistency or omission in the Contract Documents without such notice to the Designer and Owner, the Contractor shall assume full responsibility for such performance and shall bear the full costs for correction.

3.1.2 The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Designer and Owner immediately.

3.1.3 The Contractor shall perform the Work in accordance with the Contract Documents and submittals approved pursuant to Section 3.11.

3.2 SUPERVISION AND CONSTRUCTION PROCEDURES

3.2.1 The Contractor shall supervise and direct the Work using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless Contract Documents give other specific instructions concerning these matters.

3.2.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing portions of the Work under a contract with the Contractor.

3.2.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Designer in the Designer's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

3.2.4 The Contractor shall be responsible for inspection of portions of Work already performed under this Contract to determine that such portions are in proper condition to receive subsequent Work.

3.3 LABOR AND MATERIALS

3.3.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

3.3.2 The Contractor shall enforce strict discipline, good order and compliance with all applicable laws, ordinances and County policies among the Contractor's employees and other persons carrying out the Work under the Agreement. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

3.3.3 Materials, equipment or items required for a complete job which are shown on the drawings but not mentioned in the specifications or materials, equipment or items required by the specifications but not shown on the drawings, shall be furnished and installed the same as though both shown on the drawings and required by the specifications.

3.4 WARRANTY

3.4.1 The Contractor warrants to the Owner and Designer that materials and equipment furnished under the Contract will be fit for their intended purpose, of good quality and new unless otherwise required or permitted by the Contract Documents; that the Work will be free from defects not inherent in the quality required or permitted; and that the Work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. If required by the Owner or Designer, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

3.4.2 Except as otherwise specifically stated below, the Contractor shall guarantee his materials and workmanship against defect due to faulty materials or faulty workmanship or negligence for a period of twelve (12) months following Substantial Completion of the Work, unless otherwise provided for by the Parties in the certificate of completion. Where the manufacturer's warranty on equipment or parts thereof exceeds twelve (12) months, the guarantee period on such equipment or parts thereof shall be extended to include the full warranty of the manufacturer. The Contractor shall repair or replace such defective materials, equipment or workmanship to the full satisfaction of the Owner within the stipulated guarantee period without cost to the Owner.

3.5 TAXES The Contractor shall pay sales, consumer, use and similar taxes for the Work or portions thereof provided by the Contractor which are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

3.6 PERMITS, FEES AND NOTICES

3.6.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit and other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work which are customarily secured after execution of the Agreement and which are legally required when bids are received or negotiations concluded.

3.6.2 The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on performance of the Work.

3.6.3 It is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations. However, if the Contractor observes that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Designer and Owner in writing, and necessary changes shall be accomplished by appropriate Modification.

3.6.4 If the Contractor performs Work the Contractor knows or should have known to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Designer and Owner, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs.

3.7 ALLOWANCES

3.7.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities against which the Contractor makes reasonable objection.

3.7.2 Unless otherwise provided in the Contract Documents: (1) materials and equipment under an allowance shall be selected promptly by the Owner to avoid delay in the Work; (2) allowances shall cover the cost to the Contractor of materials and equipment delivered to the site and all required taxes, less applicable trade discounts; (3) Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum and not in the allowances; (4) whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by a Change Order. The amount of the Change Order shall reflect (a) the difference between actual costs and the allowances under Clause 3.7.2.(2) and (b) changes in Contractor's costs under Clause 3.7.2.(3).

3.8 SUPERINTENDENT. The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing upon request.

3.9 CONTRACTOR'S CONSTRUCTION SCHEDULES

3.9.1 Promptly after being awarded the Contract, the Contractor shall prepare and submit for the Designer's review and comment a construction schedule for the Work. The schedule shall not exceed time limits provided in the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work. If separate prime contracts are awarded by the Owner in connection with this Project, the Contractor shall additionally submit a Contractor's construction schedule for the Work to the General Contractor in order for the General Contractor to carry out its duties under Article 6.

3.9.2 The Contractor shall prepare and keep current, for the Designer's approval, a schedule of submittals which is coordinated with the Contractor's construction schedule and allows the Designer reasonable time to review submittals.

3.9.3 The Contractor shall conform to the most recent schedules.

3.10 DOCUMENTS AND SAMPLES AT THE SITE. The Contractor shall maintain at the site for the Owner one record copy of the Drawings, Specifications, addenda, Change Orders and other Modifications, in good order and marked currently to record changes and selections made during construction, and in addition approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Designer and shall be delivered to the Designer for submittal to the Owner upon completion of the Work.

3.11 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

3.11.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

3.11.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

3.11.3 Samples are physical examples, which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

3.11.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are required the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Review by the Designer is subject to the limitations of Paragraph 4.1.6.

3.11.5 The Contractor shall review, approve and submit to the Designer Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. Submittals made by the Contractor which are not required by the Contract Documents may be returned without action.

3.11.6 The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been reviewed and approved or other appropriate action taken by the Designer. Such Work shall be in accordance with approved submittals.

3.11.7 By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

3.11.8 The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Designer's review and approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Owner and Designer in writing of such deviation at the time of submittal and the Designer, after consultation with the Owner, has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Designer's approval thereof.

3.11.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, product Data, Samples or similar submittals, to revisions other than those requested by the Designer on previous submittals.

3.11.10 Informational submittals upon which the Designer is not expected to take responsive action may be so identified in the Contract Documents.

3.11.11 When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Designer shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

3.12 USE OF SITE. The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

3.13 CUTTING AND PATCHING

3.13.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

3.13.2 The Contractor shall not damage or endanger a portion of the work or fully or partially completed construction of the Owner or separate contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

3.14 CLEANING UP

3.14.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work the Contractor shall remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials.

3.14.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the cost thereof shall be charged to the Contractor, or deducted from the next payment to the Contractor.

3.15 ACCESS TO WORK. The Contractor shall provide the Owner and Designer access to the Work in preparation and progress wherever located.

3.16 ROYALTIES AND PATENTS. The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of patent rights and shall hold the Owner and Designer harmless from loss unless a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents. However, if the Contractor has, or should have, reason to believe that the required design, process or product is an infringement of a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Designer.

3.17 INDEMNIFICATION

3.17.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Designer, Designer's consultants, and agents, commissioners and employees of any of them from and against claims, damages, economic losses and expenses of any kind (including but not limited to fees and charges of engineers, attorneys, and other professionals and costs related to court action or mediation), arising out of or resulting from performance of the Work under this Agreement, provided such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including loss of use resulting therefrom, caused in whole or in part by negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable unless caused in whole or part by the negligence of Owner. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 3.17.

3.17.2 In claims against any person or entity indemnified under this Section 3.17, by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Section 3.17, shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

3.17.3 The obligations of the Contractor under this Section 3.17, shall not extend to the liability of the Designer, the Designer's consultants, and agents and employees of any of them arising out of (a) the preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or specifications, or (b) the giving of or the failure to give directions or instructions by the Designer, the Designer's consultants, and agents and employees of any of them provided such giving or failure to give is the primary cause of the injury or damage.

ARTICLE 4 ADMINISTRATION OF THE CONTRACT

4.1 ADMINISTRATION OF THE CONTRACT

4.1.1 The Designer, in consultation with the Owner's Construction Manager ("Construction Manager"), will provide administration of the Contract as described in the Contract Documents, and will be the Owner's representative during construction through final payment, and with the Owner's concurrence, from time to time during the correction period described in Paragraph 11.2. The Designer will advise and consult with the Owner. The Designer will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified by written instrument in accordance with other provisions of the Contract.

4.1.2 The Designer will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility as provided in Paragraph 3.2. The Designer will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Designer will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons performing portions of the Work.

4.1.3 Communications Facilitating Contract Administration. Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate through the Designer. Communications by and with the Designer's consultants shall be through the Designer. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Designer.

4.1.4 Based on the Designer's inspections, observations and evaluations of the Contractor's Applications for Payment, the Designer will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

4.1.5 The Designer will have authority to reject Work which does not conform to the Contract Documents. Whenever the Designer considers it necessary or advisable for implementation of the intent of the Contract Documents, the Designer will have authority to require additional inspection or testing of the Work in accordance with Paragraphs 12.7.2 and 12.7.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Designer nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Designer to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons performing portions of the Work.

4.1.6 The Designer will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Designer's action will be taken with such reasonable promptness as to cause no delay in the Work or in the activities of the Owner, Contractor or separate contractors, while allowing sufficient time in the Designer's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Designer's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Article 3. The Designer's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Designer, of any construction means, methods, techniques, sequences or procedures. The Designer's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

4.1.7 The Designer, in consultation with the Construction Manager, will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Paragraph 7.4.

4.1.8 The Designer will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion, will receive and forward to the Owner for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor, and will issue a final Certificate for Payment upon compliance with the requirements of the Contract Documents.

4.1.9 The Designer will interpret and decide matters concerning performance under and requirements of the Contract documents on written request of either the Owner or Contractor. The Designer's response to such requests will be made with reasonable promptness and within any time limits agreed upon. If no agreement is made concerning the time within which interpretations required of the Designer shall be furnished in compliance with this Paragraph 4.1.9, then delay shall not be recognized on account of failure by the Designer to furnish such interpretations until 15 days after written request is made for them.

4.1.10 Interpretations and decisions of the Designer will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Designer will endeavor to secure faithful performance by both Owner and Contractor, and will not show partiality to either.

4.1.11 The Designer's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

4.1.12 If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents as required by Article 11.2 or persistently fails to carry out Work in accordance with the Contract Documents, the Designer may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Designer to stop the Work shall not give rise to a duty on the part of the Designer to exercise this right for the benefit of the Contractor or any other person or entity.

4.2 CLAIMS AND DISPUTES

4.2.1 A Claim is a demand or assertion by one of the Parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Agreement. Claims must be made pursuant to the Dispute Resolution Procedure set forth in Paragraph 4.4. The responsibility to substantiate Claims shall rest with the party making the Claim.

4.2.2 DECISION OF DESIGNER. Claims, including those alleging an error or omission by the Designer, shall be referred initially to the Designer for action as provided in Paragraph 4.4. A decision by the Designer shall be required as a condition precedent to mediation and litigation of a Claim between any Party involved in this construction Project as to all such matters arising prior to the date final payment is due, regardless of whether such matters relate to execution and progress of the Work or the extent to which the Work has been completed. The decision by the Designer in response to a Claim shall not be a condition precedent to litigation in the event (1) the position of Designer is vacant, (2) the Designer has not received evidence or has failed to render a decision within agreed time limits, or (3) 45 days have passed after the Claim has been referred to the Designer.

4.2.3 TIME LIMITS ON CLAIMS. Claims by the Contractor must be made within 10 days after occurrence of the event giving rise to such Claim or within 10 days after the Contractor first recognizes the condition giving rise to the Claim, whichever is later. Claims must be made by written notice. An additional Claim made after the initial Claim has been implemented by Change Order will not be considered.

4.2.4 CONTINUING CONTRACT PERFORMANCE. Pending final resolution of a Claim, unless otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

4.2.5 WAIVER OF CLAIMS: FINAL PAYMENT. The making of final payment shall constitute a waiver of Claims by the Owner except those arising from: (1) unsettled claims arising out of the Agreement; or (2) failure of the Work to comply with the requirements of the Contract Documents; or (3) terms of special warranties required by the Contract Documents.

4.2.6 CLAIMS FOR CONCEALED OR UNKNOWN CONDITIONS. If conditions are encountered at the site which are (a) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (b) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than ten (10) days after first observance of the conditions. The Designer will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Designer determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Designer shall so notify the Owner and Contractor in writing stating the reasons, Claims by either party in opposition to such determination must be made within twenty-one (21) days after the Designer has given notice of the decision. If the Owner and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Designer for initial determination, subject to further proceedings pursuant to Paragraph 4.4.

4.2.7 CLAIMS FOR ADDITIONAL COST. If the Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Paragraph 10.3. If the Contractor believes additional cost is involved for reasons including but not limited to (a) a written interpretation from the Designer, (b) a written order for a minor change in the Work issued by the Designer, (c) termination of the Contract by the Owner, Claim shall be filed in accordance with the procedure established herein. This Article and Article 7, shall be the exclusive means by which the Contractor may claim additional cost or damages from the Owner, and the Contractor hereby waives any and all right to claim additional cost or damages by any other remedy including, without limitation, *quantum meruit*, subrogation, or implied contract.

4.2.8 CLAIMS FOR ADDITIONAL TIME. If the Contractor wishes to make Claim for an increase in the Time of Completion, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary. Adverse weather conditions shall not be a basis for a Claim for additional time nor costs.

4.3 INJURY OR DAMAGE TO PERSON OR PROPERTY. If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, of any of the other party's employees or agents, or of others for whose acts such party is legally liable, written notice as such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding ten (10) days after first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter. If a Claim for additional cost or time related to this Claim is to be asserted, it shall be filed as provided in Subparagraphs 4.2.7 or 4.2.8.

4.4 DISPUTE RESOLUTION PROCEDURE

4.4.1 To prevent disputes and litigation, it is agreed by the Parties that any claim, question, difficulty or dispute arising from this Agreement or the construction process shall be first submitted to the Designer to address the issue. Upon review of the Claim, the Designer shall take one or more of the following preliminary actions within ten (10) days of receipt of a Claim: (1) request additional supporting data from the claimant, (2) submit a schedule to the parties indicating when the Designer expects to take action, (3) reject the Claim in whole or in part stating reasons for rejection, (4) recommend approval of the Claim by the other Party, or (5) suggest a compromise. The Designer may also, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim.

4.4.2 If a Claim has been resolved, the Designer will prepare or obtain appropriate documentation.

4.4.3 The laws of the State of North Carolina shall apply to the interpretation and enforcement of this Agreement. Prior to initiating a legal action, any Party to this Agreement shall initiate the mediation process as provided in **Appendix A** to these General Conditions. Mediation, pursuant to this Section, shall be a pre-condition to initiating litigation concerning the dispute. During the pendency of any dispute and after a determination thereof, the Parties to the dispute shall act in good faith to mitigate any potential damages including utilization of construction schedule changes and alternate means of construction. All mediation sessions shall be held in Catawba County, North Carolina.

4.4.4 If the disputed issue cannot be resolved in mediation, the parties may seek resolution in the exclusive venue of the General Court of Justice in the County of Catawba and the State of North Carolina.

4.4.5 The dispute resolution procedure set forth in this Section shall be made available to any party involved in this construction Project including County, Contractor, Designer, Subcontractors as well as Sub-subcontractors and is a precondition to initiation of litigation concerning the dispute.

ARTICLE 5 SUBCONTRACTORS

5.1 DEFINITIONS

5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Designer the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work, including (1) Heating, ventilating, and air conditioning, (2) Plumbing, (3) Electrical, and (4) General. The Designer will promptly reply to the Contractor in writing stating whether or not the Owner or the Designer, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Designer to reply promptly shall constitute notice of no reasonable objection.

5.2.2 The Contractor shall NOT substitute any person or company listed in the Contractor's original Bid Proposal, except (1) if the listed subcontractor's bid is later determined by the Contractor to be non-responsible or non-responsive or the listed subcontractor refuses to enter into a contract for the complete performance of the work, or (2) with the approval of the Owner for good cause shown by the Contractor.

5.3 SUBCONTRACTUAL RELATIONS. By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms and conditions of the Contract Documents and this Agreement, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these documents, assumes toward the Owner and Designer. Each subcontract agreement shall incorporate by reference the applicable terms of this Agreement, and shall preserve and protect the rights of the Owner and Designer under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement,

copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement which may be at variance with the Contract Documents. Subcontractors shall similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site.

6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

6.1.3 The General Contractor shall provide for coordination of the activities of each separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate Contractors and the General Contractor in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor and separate contractors until subsequently revised.

6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights which apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10 and 11.

6.1.5 The General Contractor shall be responsible for scheduling the work of all contractors; the maintenance of the progress schedule for all prime contractors for this Project; and for the notification of the Designer of any changes in the progress schedule.

6.2 MUTUAL RESPONSIBILITY

6.2.1 The Contractor shall afford the Owner and separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Construction Manager and Designer apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor to so report shall constitute an acknowledgment that the Owner's or separate Contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

6.2.3 Costs caused by delays, by improperly timed activities, defective construction, or any other damages shall be borne by the Party responsible therefor. The Owner shall not be liable nor responsible for any delays or damages to the Contractor caused by separate Contractors or the Designer.

6.2.4 The Contractor shall promptly remedy damage wrongfully caused by the Contractor to completed or partially completed construction or to property of the Owner or separate Contractors as provided in Paragraph 10.2.5.

6.2.5 Claims and other disputes and matters in question between the Contractor and a separate Contractor shall be subject to the provisions of Sections 4.2 and 4.4, provided the separate Contractor has reciprocal obligations.

6.2.6 The Owner and each separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Paragraph 3.13.

6.3 OWNER'S RIGHT TO CLEAN UP. If a dispute arises among the Contractor, separate Contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish as described in Paragraph 3.14, the Owner may clean up and allocate the cost among those responsible as the Designer determines to be just.

ARTICLE 7 CHANGES IN THE WORK

7.1 CHANGES

7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive, or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Designer; a Construction Change Directive requires agreement by the Owner and Designer and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Designer alone pursuant to Paragraph 7.4.

7.1.3 Changes in the work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

7.1.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are so changed in a proposed Change Order or Construction Change Directive that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

7.1.5 Overhead and profit shall not exceed 10% of the value of labor and material for work performed by any contractor or subcontractor.

7.2 CHANGE ORDERS

7.2.1 A Change Order is a written instrument prepared by the Designer and signed by the Owner, Contractor, and Designer, stating their agreement upon all of the following: (1) a change in the Work; (2) the amount of the adjustment in the Contract Sum, if any; and (3) the extent of the adjustment in the Time of Completion, if any.

7.2.2 Methods used in determining adjustments to the Contract Sum may include those listed in Paragraph 7.3.3.

7.3 CONSTRUCTION CHANGE DIRECTIVES

7.3.1 A Construction Change Directive is a written order prepared by the Designer and signed by the Owner and Designer, directing a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Sum or Time of Completion, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Time of Completion being adjusted accordingly.

7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods: (1) mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation; (2) unit prices stated in the Contract Documents or subsequently agreed upon; (3) cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or (4) as provided in Paragraph 7.3.6.

7.3.4 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Designer of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Time of Completion.

7.3.5 A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in Contract Sum and Time of Completion or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

7.3.6 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the method and the adjustment shall be determined by the Designer on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, a reasonable allowance for overhead and profit. In such case, and also under clause 7.3.3(3), the Contractor shall keep and present, in such form as the Designer may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Paragraph 7.3.6 shall be limited to the following: costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance; costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed; rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others; costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and additional costs of supervision and field office personnel directly attributable to the change.

7.3.7 Pending final determination of cost to the Owner, amounts not in dispute may be included in Applications for Payment. The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Designer. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

7.3.8 If the Owner and Contractor do not agree with the adjustment in Time of Completion or the method for determining it, the adjustment or the method shall be referred to the Designer for determination.

7.3.9 When the Owner and Contractor agree with the determination made by the Designer concerning the adjustments in the Contract Sum and Time of Completion, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.

7.4 MINOR CHANGES IN THE WORK. The Designer or Construction Manager will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Time of Completion and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

ARTICLE 8 TIME

8.1 DEFINITIONS

8.1.1 Unless otherwise provided, Time of Completion is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

8.1.2 The date of commencement of the Work is the date established in the Agreement. The date shall not be postponed by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible.

8.1.3 The date of Substantial Completion is the date certified by the Designer in accordance with Paragraph 9.9.

8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

8.2 PROGRESS AND COMPLETION

8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Time of Completion is a reasonable period for performing the Work. The Contractor and the Contractor's surety shall be liable for and shall pay the Owner such sums as shall be set forth in the Agreement between Owner and Contractor as liquidated damages each calendar day of delay until the work is substantially complete.

8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by the Agreement to be furnished by the Contractor. The date of commencement of the work shall not be changed by the effective date of such insurance. Unless the date of commencement is established by a notice to proceed given by the Designer, the Contractor shall notify the Owner and Designer in writing not less than five days before commencing the Work.

8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Time of Completion.

8.3 DELAYS AND EXTENSIONS OF TIME

8.3.1 If the Contractor is delayed at any time in progress of the Work by an act or neglect of the Owner or Designer, or of an employee of either, or of a separate Contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidably casualties or other causes beyond the Contractor's control, or by delay authorized by the Owner pending litigation, or by other causes which the Designer determines may justify delay, then the Time of Completion shall be extended by Change Order for such reasonable time as the Designer may determine.

8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Paragraph 4.2.8.

8.3.3 Should the Work be interrupted or hindered by the Owner or Designer, the Contractor shall be entitled to an extension of time pursuant to Paragraph 4.2 in an amount equal to such interruption or hindrance but such interruption or hindrance shall not constitute a claim for damages nor for loss of anticipated profits by the Contractor.

8.3.4 Should the Work be delayed in whole by any act or acts of the Contractor, the Contractor shall not be entitled to an extension of time pursuant to Paragraph 4.2, nor shall such delay constitute a claim either for damages or for loss of anticipated profits by the Contractor. Should the Work be delayed in part by any act or acts of the Contractor and in part by any act or acts of the Owner or Designer, the Contractor shall be entitled to an extension of time pursuant to Paragraph 4.2 in an amount equal to that portion of the delay for which the Contractor is not responsible, but such delay shall not constitute a claim either for damages or for loss of anticipated profits by the Contractor.

8.3.5 Should the Work be delayed, interrupted or hindered, in whole or in part, by any act or acts of any separate prime contractors, the Contractor shall be entitled to an extension of time pursuant to Paragraph 4.2.8 in an amount equal to such delay, interruption or hindrance but such delay, interruption or hindrance shall not constitute a claim for damages nor for loss of anticipated profits by the Contractor.

ARTICLE 9 PAYMENTS AND COMPLETION

9.1 CONTRACT SUM. The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

9.2 SCHEDULE OF VALUES. Before the first Application for Payment, the Contractor shall submit to the Designer a Schedule of Values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Designer may require. This Schedule of Values, unless objected to by the Designer, shall be used as a basis for reviewing the Contractor's Applications for Payment.

9.3 APPLICATIONS FOR PAYMENT

9.3.1 At least twenty (20) days before the date established for each progress payment, the Contractor shall submit to the Designer an itemized Application for Payment for operations completed in accordance with the schedule of values. Such application shall be notarized, supported by such data substantiating the Contractor's right to payment as the Owner or Designer may require, such as copies of requisitions from subcontractors and material suppliers and reflecting retainage if provided for elsewhere in the Contract Documents.

9.3.2 Such applications may include requests for payment on account of changes in the Work which have been properly authorized by Construction Change Directives but not yet included in Change Orders.

9.3.3 Such applications may not include requests for payment of amounts the Contractor does not intend to pay to a Subcontractor or material supplier because of a dispute or other reason.

9.3.4 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

9.3.5 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, and as represented by signed releases or lien waivers, be free and clear of liens, claims, security interests, or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials, and equipment relating to the Work.

9.3.6 Provided an Application for Payment is received by the Designer not later than the tenth (10th) day of a month, the Owner shall make payment to the Contractor not later than the thirtieth (30th) day of the month.

9.4 RETAINAGE. To ensure proper performance of this Contract, Owner shall retain five percent (5%) of the amount of each approved Application for Payment until the Project Work is 50% complete provided that the Contractor continues to perform satisfactorily and any non-conforming Work identified in writing prior to that date has been corrected by the Contractor and accepted by the Owner. Thereafter, if the Owner determines the Contractor’s performance is unsatisfactory, the Owner may reinstate retainage in the amount of 5% for each subsequent periodic Application for Payment until the Contractor’s performance becomes satisfactory. The Project shall be deemed fifty percent (50%) complete when the Contractor's gross Project invoices, excluding the value of materials stored off-site, equal or exceed fifty percent (50%) of the value of the Contract Sum, except the value of materials stored on-site shall not exceed twenty percent (20%) of the Contractor's gross Project invoices for the purpose of determining whether the Project is fifty percent (50%) complete. Following 50% completion of the Project, the Owner may also withhold additional retainage from any

subsequent periodic payment, not to exceed 5%, in order to allow the Owner to retain 2 ½% total retainage through the completion of the Project. Within sixty (60) days after the submission of a final pay application, the Owner with written consent of the Surety shall release to the Contractor all retainage on payments held by the Owner if (1) the Owner receives a certificate of substantial completion from the Designer or design consultant in charge of this Project, or (2) the Owner receives beneficial occupancy or use of the Project. However, the Owner may retain sufficient funds to secure completion of the Project or corrections to any Work. If the Owner retains funds, the amount retained shall not exceed two and one half times the estimated cost of the Work to be completed or corrected. Any reduction in the amount of retainage on payments shall be with the consent of the Contractor's Surety. Retainer provisions contained in Contractor's subcontracts may not exceed the terms and conditions for retainage provided herein. Contractor is further required to satisfy the retainage provisions of N.C.G.S. 143- 134.1(b2) with regard to subcontracts for early finishing trades (structural steel, piling, caisson, and demolition) and to coordinate the release of retainage for such trades from the retainage held by Owner from the Contractor pursuant to statute. Nothing herein shall prevent the Owner from withholding payment to the Contractor in addition to the amounts identified herein for unsatisfactory job progress, defective construction not remedied, disputed work, or third party claims filed against the owner or reasonable evidence that a third party claim will be filed.

9.5 CERTIFICATES FOR PAYMENT

9.5.1 The Designer will, within seven (7) days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Designer determines is properly due, or notify the Contractor and Owner in writing of the Designer's reasons for withholding certification in whole or in part as provided in Paragraph 9.6.1.

9.5.2 The Designer's certification for payment shall constitute a representation to the Owner, based on the Designer's inspections at the site and on the data comprising the Contractor's Application for Payment, that the Work has progressed to the point indicated and that the inspections of the construction, repairs, or installations have been conducted with the degree of care and professional skill and judgment ordinarily exercised by a member of his profession; and that to the best of his knowledge and in the professional opinion of the Designer, the Contractor has fulfilled the obligations of such plans, specifications, and contract. The Designer's certification for payment shall be signed and sealed by the Designer and presented to the Owner. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to minor deviations from the Contract Documents correctable prior to completion and to specific qualifications expressed by the Designer. The issuance of a Certificate for Payment shall further constitute a representation by the Designer, that the Contractor is entitled to payment in the amount certified.

9.6 DECISIONS TO WITHHOLD CERTIFICATION

9.6.1 The Designer may decide not to certify payment and may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Designer's opinion, the representations to the Owner required by Paragraph 9.5.2 cannot be made. If the Designer is unable to certify payment in the amount of the Application, the Designer will notify the Contractor and Owner as provided in Paragraph 9.5.1. If the Contractor and Designer cannot agree on a revised amount, the Designer will promptly issue a Certificate for Payment for the amount for which the Designer is able to make such representations to the Owner. The Designer may also decide not to certify payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Designer's opinion to protect the Owner from loss due to: defective Work not remedied; third party claims filed or reasonable evidence indicating probable filing of such claims; failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment; reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum; damage to the Owner or another contractor; reasonable evidence that the Work will not be completed within the Time of Completion, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or persistent failure to carry out the Work in accordance with the Contract Documents.

9.6.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

9.7 PROGRESS PAYMENTS

9.7.1 After the Designer has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Designer.

9.7.2 The Contractor must promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of such Subcontractor's portion of the Work. The Contractor must, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in similar manner.

9.7.3 The Designer will furnish to a Subcontractor, upon request and if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Designer and Owner on account of portions of the Work done by such Subcontractor.

9.7.4 Neither the Owner nor Designer shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

9.7.5 Payment to material suppliers must be treated in a manner similar to that provided in Paragraphs 9.7.2, 9.7.3, and 9.7.4.

9.7.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

9.8 FAILURE OF PAYMENT. The Contractor must not stop the Work for the failure of the Designer to issue a Certificate of Payment or the Owner to make timely payment.

9.9 SUBSTANTIAL COMPLETION

9.9.1 Substantial Completion is the stage in the progress of the Project when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents, so the Owner can occupy or utilize the Work for its intended use.

9.9.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Designer a comprehensive list of items to be completed or corrected. The Contractor shall proceed promptly to complete and correct items on the list. Failure to include an item or such list does not alter the responsibility for the Contractor to complete all Work in accordance with the contract Documents. Upon receipt of the Contractor's list, the Designer will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Designer's inspection discloses any item, whether or not included on the Contractor's list, which is not in accordance with the requirements of the Contract Documents, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Designer. The Contractor shall then submit a request for another inspection by the Designer to determine Substantial Completion. When the Work or designated portion thereof is substantially complete, the Designer will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion. The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.

9.9.3 Upon Substantial Completion of the Work or designated portion thereof and upon application by the Contractor and certification by the Designer, the Owner shall make payment, reflecting adjustment in retainage, if any, for such Work or portion thereof as provided in the Contract Documents.

9.10 PARTIAL OCCUPANCY OR USE

9.10.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Designer as provided under Subparagraph 9.9.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Designer.

9.10.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Designer shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

9.10.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

9.11 FINAL COMPLETION AND FINAL PAYMENT

9.11.1 Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Designer will promptly make such inspections and, when the Designer finds the Work acceptable under the Contract Documents and the Contract fully performed, the Designer will promptly issue a Final Certificate for Payment stating that to the best of the Designer's knowledge, information and belief, and on the basis of the Designer's observations and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in said Final Certificate is due and payable. The Designer's Final Certificate for Payment will constitute a further representation that the conditions listed in Paragraph 9.11.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

9.11.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Designer (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Agreement to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5) if required by the Owner, other or additional data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances rising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

9.11.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Designer so confirms, the Owner shall, upon application by the Contractor and certification by the Designer, and without terminating the Contract, make payment

of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for work not fully completed and accepted is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Designer prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

9.11.4 Acceptance of final payment by the Contractor, Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract and construction of the Project.

10.1.2 In the event the Contractor encounters on the site material reasonably believed to be asbestos or polychlorinated biphenyl (hereinafter "PCB") which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner and Designer by phone and in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner and Contractor if in fact the material is asbestos or PCB and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or PCB, or when it has been rendered harmless, by written agreement of the Owner and Contractor, or in accordance with final determination by the Designer.

10.1.3 The Contractor shall not be required to perform without consent of Owner and Designer any Work relating to asbestos or PCB.

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to: employees working on the Project and other persons who may be affected thereby; the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

10.2.2 The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury, or loss.

10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including erecting necessary barricades or other temporary walls and structures as required during the period of construction, posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying owners and users of adjacent sites and utilities.

10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

10.2.5 The Contractor shall promptly remedy damage and loss to property referred to in Paragraphs 10.2.1.(2) and (3), caused in whole or in part by the Contractor, Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Paragraphs 10.2.1.(2) and (3), except damage or loss attributable to acts or omissions of the Owner or Designer and

not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Article 3. All costs to repair any damage and loss to property referred to in Paragraphs 10.2.1.(2) and (3), shall be the sole responsibility of the Contractor and such repair or replacement shall be performed expeditiously without cost to the Owner.

10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's Superintendent, required under Paragraph 3.8, unless otherwise designated by the Contractor in writing to the Owner and Designer.

10.2.7 The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

10.2.8 Existing utilities have been identified and described in the Contract Documents insofar as information is reasonably available, however, it is the Contractor’s responsibility to verify such information and to preserve all existing utilities whether shown in the Contract Documents or not. If utility conflicts are encountered by the Contractor during construction, Contractor shall file sufficient notice to the owners of the utilities so that they may make the necessary adjustments, as well as the Designer or Designer.

10.3 EMERGENCIES. In an emergency affecting the safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Paragraphs 4.2.7, 4.2.8 and Article 7. As soon as practicable, the Contractor must notify the Construction manager and Designer of any such emergency.

ARTICLE 11 UNCOVERING AND CORRECTION OF WORK

11.1 UNCOVERING OF WORK

11.1.1 If a portion of the Work is covered contrary to the Designer's request or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the Designer, be uncovered for the Designer's observation and be replaced at the Contractor's sole expense without change in the Time of Completion.

11.1.2 If a portion of the Work has been covered which the Designer has not specifically requested to observe prior to its being covered, the Designer may request to see such Work and it shall be uncovered by the Contractor. If such Work is not in accordance with the Contract Documents, the Contractor shall pay such costs unless the condition was caused by the Owner or a separate contractor in which event the Owner or separate contractor shall be responsible for payment of such costs. If such work is in accordance with the Contract Documents, the Owner, by appropriate Change Order, shall be charged with the cost of uncovering and replacement.

11.2 CORRECTION OF WORK

11.2.1 The Contractor shall promptly correct Work rejected by the Designer or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear any and all costs of correcting such rejected Work, including additional testing and inspections and compensation for the Designer's services and expenses made necessary thereby.

11.2.2 If, within one year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Paragraph 9.10.1 or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. This period of one year shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the work. This obligation under this Paragraph 11.2.2 shall survive

acceptance of the Work under the Contract and termination of the Contract. The Owner shall give such notice promptly after discovery of the condition.

11.2.3 The Contractor shall remove from the site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

11.2.4 If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct it in accordance with Paragraph 2.2. If the Contractor does not proceed with correction of such nonconforming Work within a reasonable time fixed by written notice from the Designer, the Owner may remove it and store the salvageable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of such removal and storage within ten (10) days after written notice, the Owner may upon ten (10) additional days' written notice sell such materials and equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including compensation for the Designer's services and expenses made necessary thereby. If such proceeds of sale do not cover costs which the Contractor should have borne, the Contract Sum shall be reduced by the deficiency. If payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner.

11.2.5 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

11.2.6 Nothing contained in this Section 11.2 shall be construed to establish a period of limitation with respect to other obligations which the Contractor might have under the Contract Documents. Establishment of the time period of one year as described in Paragraph 11.2.2, relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the work.

11.3 ACCEPTANCE OF NONCONFORMING WORK. If the Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 12 MISCELLANEOUS PROVISIONS

12.1 GOVERNING LAW. This Agreement shall be governed by and in accordance with the laws of the State of North Carolina. All actions relating in any way to this Contract, shall be brought exclusively in the General Court of Justice in the County of Catawba and the State of North Carolina, after exhausting the dispute resolution procedure set forth in Section 4.4, herein.

12.2 SUCCESSORS AND ASSIGNS. The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to the other Party hereto and to partners, successors, assigns, and legal representatives of such other Party in respect to covenants, agreements, and obligations contained in the Contract Documents. Neither Party to the Contract shall assign the Contract as a whole without written consent of the other. If either Party attempts to make such an assignment without such consent, that Party shall nevertheless remain legally responsible for all obligations under the Contract.

12.3 WRITTEN NOTICE. Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail to the business address listed in the Agreement.

12.4 RIGHTS AND REMEDIES. Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

12.5 WAIVER OF RIGHTS. No action or failure to act by the Owner or Designer shall constitute an obligation or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

12.6 COMPLIANCE WITH LAWS. Contractor represents that it is in compliance with all Federal, State, and local laws, regulations or orders, as amended or supplemented. The implementation of this contract will be carried out in strict compliance with all Federal, State, or local laws regarding discrimination in employment.

12.7 TESTS AND INSPECTIONS

12.7.1 Tests, inspections, and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and the Owner shall bear the costs of tests, inspections, and approvals. Should any retest be necessary due to the failure of the Work to pass the first test or for any other reason whatsoever, the Contractor shall bear all related costs of retests, inspections or re-inspections, and approvals. The Contractor shall give the Designer timely notice of when and where tests and inspections are to be made so the Designer may observe such procedures.

12.7.2 If the Designer, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Paragraph 12.7.1, the Designer will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Designer of when and where tests and inspections are to be made so the Designer may observe such procedures.

12.7.3 If such procedures for testing, inspection or approval under Paragraphs 12.7.1 and 12.7.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, the Contractor shall bear all costs made necessary by such failure including the costs of bringing the Work into compliance with the Contract Documents as well as the costs of any repeated procedures, testing, inspection or approval and the compensation for the additional services and expenses of the Designer.

12.7.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Designer.

12.7.5 If the Designer is required by the Contract Documents to observe tests, inspections, or approvals, the Designer will do so promptly and, where practicable, at the normal place of testing.

12.7.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

12.8 COMMENCEMENT OF STATUTORY LIMITATION PERIOD. As between the Owner and Contractor:

Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion.

Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the Final Certificate for Payment, any

applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the Final Certificate for Payment.

After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the Final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any warranty provided under Paragraph 3.4, the date of any correction of the Work or failure to correct the Work by the Contractor under Section 11.2 or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

ARTICLE 13 TERMINATION OR SUSPENSION OF THE CONTRACT

13.1 TERMINATION BY THE CONTRACTOR

13.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 180 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor, for any of the following reasons: issuance of an order of a court or other public authority having jurisdiction; an act of government, such as a declaration of national emergency, making material unavailable; because the Designer has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Paragraph 9.6.

13.1.2 If one of the above reasons exists, Contractor shall send written notice of the condition to Owner and Designer and Owner and Designer shall have thirty (30) days to cure or correct the condition. If owner fails to cure the Condition, the Contractor may, upon seven (7) additional days' written notice to the Owner and Designer, terminate the Contract and recover from the Owner payment for work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, not including overhead, profit, or damages. In no event shall Owner be responsible for lost profits, special or consequential damages.

13.2 TERMINATION BY THE OWNER FOR CAUSE

13.2.1 The Owner may terminate the Contract if the Contractor: refuses or fails to supply enough properly skilled workers or proper materials; fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors; persistently disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction; or otherwise is in substantial breach of a provision of the Contract Documents.

13.2.2 When any of the above reasons exist, the Owner, upon certification by the Designer that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven (7) days written notice and opportunity to cure, terminate employment of the Contractor and may, subject to any prior rights of surety: take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor; and finish the Work by whatever reasonable method the Owner may deem expedient.

13.2.3 When the Owner terminates the Contract for one of the reasons stated in Paragraph 13.2.1, the Contractor shall not be entitled to receive further payment.

13.2.4 If the unpaid balance of the Contract Sum does not cover the cost of finishing the Work, the Contractor shall pay the difference to the Owner. The amount to be paid to the Owner, shall be certified by the Designer, upon application, and this obligation for payment shall survive termination of the Contract.

13.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

13.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay, or interrupt the Work in whole or in part for such period of time as the Owner may determine.

13.4 TERMINATION BY OWNER FOR CONVENIENCE

13.4.1 The Owner may, at any time, terminate the Contract for the Owner's Convenience and without cause.

13.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall:

1. Cease operations as directed by the Owner in the notice;
2. Take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
3. Except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

13.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work properly executed and costs incurred by reason of such termination. Termination shall not relieve the Contractor of its responsibilities for any completed portion of the Work nor shall it relieve its sureties of their obligation for and concerning any claims arising out of the Work performed.

13.4.4 In the event of termination by the Owner for convenience, the Contractor shall not be entitled to any other compensation, including compensation for lost profit, lost opportunity, or any other direct, special or consequential cost, loss or damage.

13.5 BANKRUPTCY

13.5.1 The bankruptcy of the Contractor shall not terminate this Contract until such time that it is specifically rejected by the Trustee or Contractor in bankruptcy. During the election period the Contractor has to assume or reject this Contract, the Contractor shall continue to perform its Work under the Contract.

13.5.2 In the event the Contractor in Bankruptcy assumes the Contract, the Contractor shall apply progress payments to all of its unpaid obligations on this Project before using any of these monies for either administrative expenses of the bankruptcy or as general assets of the estate.

13.6 SECURITY OF NON-PUBLIC RECORDS.

13.6.1 Pursuant to NCGS § 132-1.7 entitled, "Sensitive Public Security Information", public records, as defined in NCGS § 132-1, shall not include information containing specific details of public security plans and arrangements or the detailed plans and drawings of public buildings and infrastructure facilities. Therefore, all information provided, received, gathered or obtained by Contractor containing specific details of public security plans and arrangements or the detailed plans and drawings of public buildings and infrastructure facilities shall be held confidential and shall be used by the Contractor only for the purpose of fulfilling the terms of this Agreement. All plans and drawings shall be returned to the County, or otherwise destroyed at the direction of the County, upon termination or expiration of this Agreement. Any breach of this paragraph by Contractor shall result in the immediate termination of this contract.

Appendix A

RULES IMPLEMENTING MEDIATED SETTLEMENT CONFERENCES IN CATAWBA COUNTY

Adopted: February 5, 2024

Table of Rules

RULE

1. Initiating Mediated Settlement Conferences
   - A. Purpose of Mandatory Settlement Conferences
   - B. Initiating the Dispute Resolution Process
   - C. Condition Precedent to Litigation

2. Selection of a Mediator
   - A. Selection of a Certified Mediator by Agreement of the Parties
   - B. Withdrawal or Disqualification of a Mediator

3. The Mediated Settlement Conference
   - A. Where the Conference is to be Held
   - B. When the Conference is to be Held
   - C. Requests to Extend the Deadline for Completion
   - D. Recesses
   - E. Postponements
   - F. Construction Projects

4. Duties of Parties and Other Participants
   - A. Attendance
   - B. Finalizing the Agreement
   - C. Mediation Fee
   - D. Failure to Compensate the Mediator

5. Authority and Duties of Mediators
   - A. Authority of Mediators
   - B. Duties of Mediators

6. Compensation of the Mediator

7. Mediator Certification

8. Rule Amendments

9. Time Limits

10. No Recording

RULE 1. INITIATING MEDIATED SETTLEMENT CONFERENCES

A. Purpose of Mandatory Settlement Conferences. Pursuant to Catawba County Code Section 8-35 and NCGS §143-128(f1), these Rules are promulgated to implement a system of settlement events which are designated to focus the parties' attention on settlement rather than on claim preparation and to provide a structured opportunity for settlement negotiations to take place. Nothing herein is intended to limit or prevent the parties from engaging in settlement procedures voluntarily at any time prior to or during commencement of the dispute resolution process.

B. Initiating the Dispute Resolution Process.

1. Any party to a Catawba County contract governed by Catawba County Code Chapter(s) 8 or 30 and who is a party to a dispute arising out of the construction process in which the amount in controversy is at least $15,000 may submit a written request to Catawba County for mediation of the dispute.

2. Prior to submission of a written request for mediation to Catawba County, the parties should give notice of any and all claims in accordance with their respective contracts, obtain decisions on the claims as required or allowed by their respective contracts, and attempt to resolve the dispute according to the terms and conditions in their respective contracts. The Mediator may adjourn any mediated settlement conference if the Mediator believes, in his or her sole discretion, that the parties have not satisfied all of the terms and conditions of their respective contracts and that doing so will enhance the prospects for a negotiated settlement.

C. Condition Precedent to Litigation. Before any party to a Contract may commence a civil action against Catawba County seeking remedies for breach or non-performance of the Contract by the County, said party must first initiate the dispute resolution process under these rules and attend and participate in good faith in the mediated settlement conference.

RULE 2. SELECTION OF A MEDIATOR

A. Selection of a Certified Mediator by Agreement of the Parties. The parties shall select a Certified Mediator within twenty-one (21) days of receipt by the County of the request for mediation. If the Mediator selected is not available or declines to participate for any reason, the parties shall select another Certified Mediator. If the parties are unable to agree on a mediator within twenty-one (21) days of the request for mediation, the County shall have the right in its absolute discretion to appoint a Certified Mediator.

B. Withdrawal or Disqualification of a Mediator. Any party may request replacement of a mediator by Catawba County for good cause. If a mediator withdraws or is disqualified, then the parties shall select another Certified Mediator within three (3) days of the notice of withdrawal or disqualification. A mediator who has withdrawn or been disqualified shall not be entitled to receive an administrative fee, unless the mediation has been commenced. If the parties do not select and designate a mediator within three (3) days from the notice of withdrawal or disqualification, the County shall have the right in its absolute discretion to appoint a Certified Mediator.

RULE 3. THE MEDIATED SETTLEMENT CONFERENCE

A. Where the Conference is to be Held. Unless all parties and the mediator otherwise agree, the mediated settlement conference shall be held in Catawba County. The mediator shall be responsible for reserving a place and making arrangements for the conference and for giving timely notice of the time and location of the conference to all attorneys, unrepresented parties and other persons and entities required to attend.

B. When the Conference is to be Held. The mediation shall be completed within ninety (90) days after selection of the mediator.

C. Request to Extend the Deadline for Completion. A party, or the mediator, may request that Catawba County extend the deadline for completion of the mediated settlement conference. Such request shall state the reasons the extension is sought and shall be served by the moving party upon the other parties and the mediator. If any party does not consent to the request, said party shall promptly communicate its objection, and the reasons for its objection, to Catawba County. Catawba County may grant the request by setting a new deadline for completion of the conference, or deny the request to extend the deadline, resulting in an impasse of the mediation.

D. Recesses. The mediator may recess the mediated settlement conference at any time and may set times for reconvening. If the time for reconvening is set before the conference is recessed, no further notification is required for persons present at the conference.

E. Postponements. A mediated settlement conference session may be postponed for good cause only after notice by the movant to all parties of the reason for the postponement and a finding of good cause by Catawba County.

F. Construction Project. The mediated settlement conference or the matter subject of the mediated settlement conference shall not be cause for the delay of the construction project which is the focus of the dispute.

RULE 4. DUTIES OF PARTIES AND OTHER PARTICIPANTS

A. Attendance.

1. All parties to the dispute must attend the mediated settlement conference. Failure of a party to a construction contract to attend the mediated settlement conference will result in Catawba County's withholding of monthly payment to that party until such party attends the mediated settlement conference.

2. Attendance shall constitute physical attendance, not by telephone or other electronic means. Notwithstanding the foregoing, all parties and persons required to attend a mediated settlement conference may agree to conduct the conference using remote technology, or using a hybrid of in-person attendance and remote technology.

3. Any party that is a nongovernmental entity shall be represented at the mediated settlement conference by an officer, employee, or agent who is not the entity's outside counsel and who has been authorized to decide whether, and on what terms, to settle the action on behalf of the entity, or who has been authorized to negotiate on behalf of the entity and can promptly communicate during the conference with persons who have decision-making authority to settle the action; provided, however, that if a specific procedure is required by law (e.g., a statutory pre-audit certificate) or the entity's governing documents (e.g., articles of incorporation, bylaws, partnership agreement, articles of organization, or operating agreement) to approve the terms of the settlement, then the representative shall have the authority to negotiate and make recommendations to the applicable approval authority in accordance with that procedure.

4. Any party that is a governmental entity shall be represented at the mediated settlement conference by an employee or agent who is not the entity's outside counsel and who: (i) has authority to decide on behalf of the entity whether and on what terms to settle the action; (ii) has been authorized to negotiate on behalf of the entity and can promptly communicate during the conference with persons who have decision-making authority to settle

the action; or (iii) has authority to negotiate on behalf of the entity and to make a recommendation to the entity's governing board, if under applicable law the proposed settlement terms can be approved only by the entity's governing board. Notwithstanding anything in these rules to the contrary, any agreement reached which involves a governmental entity may be subject to the provisions of NCGS §159-28(a).

5. Attorneys on behalf of parties may attend the mediated settlement conference but are not required to do so.

6. Sureties or insurance company representatives are not required to attend the mediated settlement conference unless any monies paid or to be paid as a result of any agreement reached as a result of mediation require their presence or acquiescence. If such agreement or presence is required, then authorized representatives of the surety or insurance company must attend the mediation.

B. Finalizing the Agreement. If an agreement is reached in the mediated settlement conference, parties to the agreement shall reduce the terms to writing and sign it along with their counsel, if counsel is present, prior to the adjournment of the conference. If additional time is required to formalize an agreement, the mediator may recess the conference and set a time certain for reconvening pursuant to Rule 3(D). The time for reconvening shall be as soon as practicable to allow for formalization of the agreement.

C. Mediation Fee. The mediation fee and any ancillary fees shall be paid in accordance with Rule 6 Compensation of the Mediator.

D. Failure to Compensate the Mediator. Any party's failure to compensate the mediators in accordance with Rule 6 shall subject that party to a withholding of said amount of money from the party's monthly payment by Catawba County.

RULE 5. AUTHORITY AND DUTIES OF MEDIATORS

A. Authority of Mediators.

1. Control of Conference. The mediator shall at all times be in control of the mediated settlement conference and the procedures to be followed.

2. Private Consultation. The mediator may communicate privately with any participant or counsel prior to and during the mediated settlement conference. The fact that private communications have occurred with a participant shall be disclosed to all other participants at the beginning of the conference.

3. Scheduling the Conference. The mediator shall make a good faith effort to schedule the mediated settlement conference at a time that is convenient with the participants, attorneys and mediator. In the absence of agreement, the mediator shall select the date for the mediated settlement conference.

B. Duties of Mediators.

1. The mediator shall define and describe the following at the beginning of the mediated settlement conference:
   a. The process of mediation;
   b. The difference between mediation and other forms of conflict resolution;
   c. The costs of the mediated settlement conference;

a. That the mediated settlement conference is not a trial, the mediator is not a judge, and the parties retain their legal rights if they do not reach settlement;
b. The circumstances under which the mediator may meet and communicate privately with any of the parties or with any other person;
f. Whether and under what conditions communications with the mediator will be held in confidence during the conference;
g. The inadmissibility of conduct and statements as provided by NCGS §7A-38.1(l);
h. The duties and responsibilities of the mediator and the participants; and
i. Any agreement reached will be reached by mutual consent.

2. Disclosure. The mediator has a duty to be impartial and to advise all participants of any circumstance bearing on possible bias, prejudice or partiality.

3. Declaring an Impasse. It is the duty of the mediator to timely determine that an impasse exists and that the mediated settlement conference should end.

4. Reporting the Results of the Conference. The mediator shall report to Catawba County within ten (10) days of the mediated settlement conference whether or not an agreement was reached by the parties. If an agreement was reached, the report shall state the nature of said agreement. The mediator's report shall inform Catawba County of the absence of any party known to the mediator to have been absent from the mediated settlement conference without permission. Catawba County must require the mediator to provide statistical data for evaluation of the mediated settlement conference program.

5. Scheduling and Holding the Conference. It is the duty of the mediator to schedule the mediated settlement conference and conduct it prior to the deadline of completion set by these Rules. Deadlines for completion of the conference shall be strictly observed by the mediator unless said time limit is changed by a written order from Catawba County.

RULE 6. COMPENSATION OF THE MEDIATOR

The parties shall compensate the mediator for mediation services, and any ancillary fees related to the mediation, at the rate in accordance with the rate charged for Superior Court mediation. The parties shall also pay to the mediator a one-time per case administration rate in accordance with the rate charged for Superior Court mediation, which is due upon appointment.

RULE 7. MEDIATOR CERTIFICATION

All mediators shall be properly certified in accordance with the rules certifying mediators in Superior Court in North Carolina. (Except when otherwise allowed by Catawba County upon the request of the parties to the mediation.) When selecting mediators, the parties may designate a preference for mediators with a background in construction law or public construction contracting. Such requirements, while preferred, are not mandatory under these Rules. All mediators chosen must either demonstrate they are certified in accordance with the Rules for Mediated Settlement Conferences in Superior Court or must gain the consent of Catawba County to mediate any dispute in accordance with these Rules.

RULE 8. RULE AMENDMENTS

These Rules are subject to amendment by Catawba County at any time the County deems appropriate.

RULE 9. TIME LIMITS

Any time limit provided for by these Rules may be waived or extended by the County for good cause shown.

RULE 10. NO RECORDING

There shall be no stenographic, audio, or video recording of the mediation process by any participant. This prohibition includes recording either surreptitiously or with the agreement of the parties.

ATTACH INSURANCE CERTIFICATES HERE

NOTICE TO PROCEED

Date: _____

Project: Blackburn Resource Recovery Facility Operator's Building	
Owner: Catawba County	Owner's Contract No.:
Contract: Blackburn Resource Recovery Facility Operator's Building	Engineer's Project No.: 26.00701
Contractor:	
Contractor's Address:	

You are notified that the Contract Times under the above Contract will commence to run on _____. On or before the 10th day following this date, you are to commence work and start performing your obligations under the Contract Documents. In accordance with the Agreement, the date of Substantial Completion is _____, and the date of Final Completion is _____.

Contractor	Owner
	Given by:
Authorized Signature	Authorized Signature
Title	Title
Date	Date

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

MODIFIED STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

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MODIFIED STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

TABLE OF CONTENTS

Page

Article 1 – Definitions and Terminology 1
1.01 Defined Terms 1
1.02 Terminology 5

Article 2 – Preliminary Matters 6
2.01 Delivery of Bonds and Evidence of Insurance 6
2.02 Copies of Documents 7
2.03 Commencement of Contract Times; Notice to Proceed 7
2.04 Starting the Work 7
2.05 Before Starting Construction ..... Intentionally Deleted
2.06 Preconstruction Conference; Designation of Authorized Representatives 7
2.07 Submission and Acceptance of Schedules 7

Article 3 – Contract Documents: Intent, Amending, Reuse 8
3.01 Intent 8
3.02 Reference Standards 9
3.03 Reporting and Resolving Discrepancies 9
3.04 Amending and Supplementing Contract Documents 11
3.05 Reuse of Documents 11
3.06 Electronic Data 12

Article 4 – Availability of Lands; Subsurface and Physical Conditions; Hazardous Environmental Conditions; Reference Points 12
4.01 Availability of Lands 12
4.02 Subsurface and Physical Conditions 13
4.03 Differing Subsurface or Physical Conditions 14
4.04 Underground Facilities 15
4.05 Reference Points 16
4.06 Hazardous Environmental Condition at Site 17

Article 5 – Bonds and Insurance 18
5.01 Performance, Payment, and Other Bonds 18
5.02 Licensed Sureties and Insurers 19
5.03 Certificates of Insurance 19
5.04 Contractor's Insurance 19
5.05 Owner's Liability Insurance 22
5.06 Property Insurance 23
5.07 Waiver of Rights 24
5.08 Receipt and Application of Insurance Proceeds 24
5.09 Acceptance of Bonds and Insurance; Option to Replace 24

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5.10 Partial Utilization, Acknowledgment of Property Insurer 24

Article 6 – Contractor's Responsibilities 25
6.01 Supervision and Superintendence 25
6.02 Labor; Working Hours 26
6.03 Services, Materials, and Equipment 27
6.04 Progress Schedule 28
6.05 Substitutes and "Or-Equals" 30
6.06 Concerning Subcontractors, Suppliers, and Others 32
6.07 Patent Fees and Royalties 35
6.08 Permits 35
6.09 Laws and Regulations 34
6.10 Taxes 36
6.11 Use of Site and Other Areas 36
6.12 Record Documents 37
6.13 Safety and Protection 36
6.14 Safety Representative 37
6.15 Hazard Communication Programs 37
6.16 Emergencies 39
6.17 Shop Drawings and Samples 39
6.18 Continuing the Work 42
6.19 Contractor's General Warranty and Guarantee 42
6.20 Indemnification 43
6.21 Delegation of Professional Design Services 44
6.22 Owner-Purchased Material and Equipment 43

Article 7 – Other Work at the Site 45
7.01 Related Work at Site 45
7.02 Coordination 46
7.03 Legal Relationships 46
7.04 Claims Between Contractors 46

Article 8 – Owner's Responsibilities 47
8.01 Communications to Contractor 47
8.02 Replacement of Engineer 47
8.03 Furnish Data 47
8.04 Pay When Due 47
8.05 Lands and Easements; Reports and Tests 47
8.06 Insurance ..... Intentionally Deleted
8.07 Change Orders 47
8.08 Inspections, Tests, and Approvals 46
8.09 Limitations on Owner's Responsibilities 48
8.10 Undisclosed Hazardous Environmental Condition 48
8.11 Evidence of Financial Arrangements ..... Intentionally Deleted
8.12 Compliance with Safety Program ..... Intentionally Deleted

Article 9 – Engineer's Status During Construction 48
9.01 Owner's Representative 48

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9.02 Visits to Site 48
9.03 Construction Field Representative 49
9.04 Authorized Variations in Work 49
9.05 Rejecting Defective Work 50
9.06 Shop Drawings, Change Orders and Payments 50
9.07 Determinations for Unit Price Work 50
9.08 Decisions on Requirements of Contract Documents and Acceptability of Work 50
9.09 Limitations on Engineer's Authority and Responsibilities 51
9.10 Compliance with Safety Program ..... Intentionally Deleted

Article 10 – Changes in the Work; Claims 52
10.01 Authorized Changes in the Work 52
10.02 Unauthorized Changes in the Work 52
10.03 Execution of Change Orders 52
10.04 Notification to Surety 53
10.05 Claims 53

Article 11 – Cost of the Work; Allowances; Unit Price Work 55
11.01 Cost of the Work 55
11.02 Allowances 58
11.03 Unit Price Work 58

Article 12 – Change of Contract Price; Change of Contract Times 59
12.01 Change of Contract Price 59
12.02 Change of Contract Times 60
12.03 Delays 60

Article 13 – Tests and Inspections; Correction, Removal or Acceptance of Defective Work 63
13.01 Notice of Defects 63
13.02 Access to Work 63
13.03 Tests and Inspections 63
13.04 Uncovering Work 64
13.05 Owner May Stop the Work 65
13.06 Correction or Removal of Defective Work 65
13.07 Correction Period 65
13.08 Acceptance of Defective Work 66
13.09 Owner May Correct Defective Work 67

Article 14 – Payments to Contractor and Completion 68
14.01 Schedule of Values 68
14.02 Progress Payments 68
14.03 Contractor's Warranty of Title 73
14.04 Substantial Completion 73
14.05 Partial Utilization 74
14.06 Final Inspection 75
14.07 Final Payment 75
14.08 Final Completion Delayed 76
14.09 Waiver of Claims 77

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Article 15 – Suspension of Work and Termination 77
15.01 Owner May Suspend Work 77
15.02 Owner May Terminate for Cause 77
15.03 Owner May Terminate For Convenience 78
15.04 Contractor May Stop Work or Terminate 79

Article 16 – Dispute Resolution 80
16.01 Methods and Procedures 80

Article 17 – Miscellaneous 80
17.01 Giving Notice 80
17.02 Computation of Times 80
17.03 Cumulative Remedies 81
17.04 Survival of Obligations 81
17.05 Controlling Law 81
17.06 Headings 81

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below have the meanings indicated which are applicable to both the singular and plural. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.

3. *Application for Payment*—The form provided in the Contract Documents is to be used by Contractor during the course of the Work in requesting progress or final payments and is to be accompanied by supporting documentation as required by the Contract Documents.

4. *Asbestos*—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. *Bid*—The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. *Bidder*—The individual or entity who submits a Bid directly to Owner.

7. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).

8. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.

9. *Change Order*—A document recommended by Engineer, signed by Contractor and Owner, which authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

10. *Claim*—A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. *Construction Field Representative (CFR)*—The authorized representative of Engineer who may be assigned to the Site or any part thereof.

12. *Contract*—The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

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13. *Contract Documents*—Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

14. *Contract Price*—The Monies payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).

15. *Contract Times*—The number of calendar days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.

16. *Contractor*—The individual or entity with whom Owner has entered into the Agreement.

17. *Cost of the Work*—See Paragraph 11.01 for definition.

18. *Drawings*—The part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

19. *Effective Date of the Agreement*—The date indicated in the Agreement on which it becomes effective, but only if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

20. *Engineer*—The individual or entity named as such in the Agreement.

21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not involve a change in the Contract Price or the Contract Times.

22. *General Requirements*—Sections of Division 1 of the Specifications.

23. *Hazardous Environmental Condition*—The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances which present a substantial danger to persons or property.

24. *Hazardous Waste*—The same as the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) and as amended from time to time.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*—Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

27. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

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28. *Notice of Award*—The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder, with the conditions precedent listed therein, Owner will sign and deliver the Agreement. The Notice of Award shall not be construed as an agreement or contract. Contractor has no rights or remedies against Owner until the Notice to Proceed has been issued.

29. *Notice to Proceed*—A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor must start to perform the Work under the Contract Documents.

30. *Owner*—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

31. *PCBs*—Polychlorinated biphenyls.

32. *Petroleum*—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, or oil mixed with other non-Hazardous Waste and crude oils.

33. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

34. *Project*—The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

35. *Project Manual*—The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents. The Project Manual contains any and all addenda issued, documents executed by the Owner and Contractor or Engineer after bidding, and all attachments and exhibits thereto, up to and including the executed copy of the Notice to Proceed.

36. *Radioactive Material*—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) and as amended from time to time.

37. *Samples*—Physical examples of materials, equipment, or workmanship which are representative of some portion of the Work and establish the standards by which such portion of the Work will be judged.

38. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

39. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

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40. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

41. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

42. *Specifications*—The part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

43. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

44. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be fully utilized for the purposes for which it is intended. As a precedent condition to Substantial Completion the Owner shall have received all certificates of occupancy and any other necessary permits for beneficial occupancy. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

45. *Successful Bidder*—The Bidder submitting a responsive Bid to whom Owner makes an award.

46. *Supplementary Conditions*—The part of the Contract Documents which amends or supplements these Modified General Conditions.

47. *Supplier*—A manufacturer, fabricator, supplier, distributor, material man, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.

48. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.

49. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those which convey electricity, gases,

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steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

50. *Unit Price Work*—Work to be paid for on the basis of unit prices.

51. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

52. *Work Change Directive*—A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence the parties expect the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 *Terminology*

A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. The exercise of professional judgment, action, or determination is to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day:*

The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

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The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient because it:

a. does not conform to the Contract Documents or general standards of workmanlike construction or published authorities which govern the proper use and application of a particular material or component including, but not limited, to literature published by manufacturers and trade organizations; or

b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide:*

1. The word "furnish," when used in connection with services, materials, or equipment, means to supply and deliver services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, means to put into use or place in final position services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, means to furnish and install services, materials, or equipment complete and ready for intended use.

4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor must also deliver to Owner the bonds as Contractor is required to furnish. The Owner has sole authority to review and reject any bonds as nonconforming.

B. Within fifteen (15) calendar days after the Effective Date of the Agreement, but before any Work at the Site is started, Contractor must deliver to Owner, with a copy to Engineer, certificates and other evidence of insurance requested by Owner which Contractor is required to purchase and

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maintain in accordance with Article 5 of these Modified General Conditions. The Owner has sole authority to review and reject any insurance as nonconforming.

2.02 *Copies of Document*

Engineer will furnish to the successful Contractor up to three (3) sets of the Project Manual. Additional sets will be made available by the Engineer to the Contractor at the cost set forth in the Advertisement for Bids for this project or the actual cost for reproduction whichever is greater.

2.03 *Commencement of Contract Times; Notice to Proceed*

The Contractor must complete all of the work contracted herein, in an acceptable manner and within the established Contract Time. The Contract Time shall commence on the start date given in the Notice to Proceed, and run continuously each and every calendar day following, except as provided, and in accordance with Paragraph 17.02. Times shall be of the essence of this Contract.

2.04 *Starting the Work*

The Contractor must commence work on or before the tenth (10th) calendar day after the date of the Notice to Proceed or as may be differently stated in the Notice to Proceed. Contractor shall not start work prior to the date set in the Notice to Proceed.

2.05 (Intentionally Deleted)

2.06 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a Preconstruction Conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the Contractor's schedule for completion of the work, policies and procedures for submittal of Shop Drawings and other submittals, presentation and processing of Applications for Payment, and maintaining records required by the Contract Documents. If agreed between Owner and Contractor, the Preconstruction Conference may be held prior to the commencement of the Contract Times.

B. At this conference Owner and Contractor each must designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals must have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of, and legally bind each respective party.

2.07 *Submission and Acceptance of Schedules*

Prior to presentation of the first Application for Payment, the Contractor must submit the below schedules. No progress payment will be made to Contractor until acceptable Schedules are submitted to Engineer. All schedules must be coordinated and logically related in time and value for the various stages of work.

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1. The Progress Schedule. The Progress Schedule will be computer generated, utilizing the critical path method (CPM), indicating the dates and duration for completing the various stages of the Work, including any milestones. The level of detail a number of tasks shown in the Progress Schedule will be commensurate with the complexity of the work. The Progress Schedule must be acceptable to Engineer if at a minimum it clearly and accurately demonstrates an orderly progression and completion of the work within the contract times. Contractor is solely responsible for scheduling and completing the work within the contract time. Any approval or acceptance of the schedule shall not impose on Engineer responsibility for the progress schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility for completion within the contract time.

2. The Schedule of Submittals. The Schedule of Submittals must provide a workable arrangement for the Engineer to timely review and process the required submittals. The Schedule of Submittals must also include a list of manufacturers and suppliers. Approval of any schedule by Engineer shall not relieve the Contractor from any obligations under the Contract.

3. The Schedule of Values. The Contractor's Schedule of Values must provide a reasonable allocation of the Contract Price to component parts of the Work. Contractor's Schedule of Values for all of the Work must include quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail, commensurate with the complexity of the Work, to serve as the basis for progress payments during performance of the Work. The Schedule of Values must have line items for project closeout including, demobilization, record drawings, completion of the punch list and project restoration and final cleanup. Approval of any Schedule by Engineer shall not relieve the Contractor from any obligations under the Contract.

4. Cash Flow Schedule. Contractor's Cash Flow Schedule must be a scheduled and forecasted value of the anticipated payment requests for the Work. The amounts shown will be considered an estimate which may differ from the actual amounts requested.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. The intent of the Contract Documents is to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result must be provided whether or not specifically called for, at no additional cost to Owner.

C. Clarifications and interpretations of the Contract Documents will be issued by Engineer as provided in Article 9.

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3.02 *Reference Standards*

Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether the reference is specific or implied, shall mean the standard, specification, manual, code, or Laws or Regulations in effect as of the date Engineer sealed, signed, and dated the Contract Documents, except as may be otherwise specifically stated in the Contract Documents.

2. The Contract Documents shall be deemed to include applicable building codes, laws and regulations, relevant published industry and trade organization standards, as well is the published requirements of any product manufacturer. However, no such provision or instruction shall have the effect of assigning to Owner, Engineer, or any of their officers, elected officials, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Review of Contract Documents before Starting Work*: Before undertaking each part of the Work, Contractor must carefully study and compare the Contract Documents and check and verify pertinent figures and all applicable field measurements. Contractor must promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby. Contractor's failure to notify Engineer of any discrepancy prior to commencement of Work shall constitute a waiver of Contractor's right to seek additional compensation or damages for any alleged discrepancy later discovered by Contractor.

a. Contractor (and any Subcontractor responsible for the performance of all or any part of such Work) must field verify the accuracy of all grades, elevations, dimensions, locations, orientation and measurements including locations of any underground utilities or other features which may be shown generally on the drawings for informational purposes only. The Contractor must promptly, in writing, notify the Engineer of any discrepancies. Contractor's failure to notify Engineer of any discrepancy prior to commencement of Work shall constitute a waiver of Contractor's right to seek additional compensation or damages for any alleged discrepancy later discovered by Contractor.

2. *Contractor's Review of Contract Documents During Performance of Work*: If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, Contractor must promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract

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Documents has been issued by one of the methods indicated in Paragraph 3.04. Contractor's failure to notify Engineer of any discrepancy prior to commencement of Work shall constitute a waiver of Contractor's right to seek additional compensation or damages for any alleged discrepancy later discovered by Contractor.

a. In the event Contractor determines that some aspect of the Contract Documents require clarification or interpretation by Engineer, Contractor must submit a Request for Information (RFI) in writing to Engineer in a format provided by Engineer. RFIs may only be submitted by the Contractor and must be in the form required by Engineer. Verbal RFI or a RFI presented on an unapproved form must be rejected. Any delay caused by Engineer's refusal to accept a verbal RFI or a RFI presented on an unapproved form will be attributed solely to Contractor. Each RFI must be limited to a single issue. Information that is discernible from the Contract Documents as well as issues concerning construction means, methods, techniques, sequences or safety will not be addressed by Engineer.

b. Contractor must clearly and concisely state the issue for which clarification or interpretation is sought and why a clarification or interpretation is needed. The RFI process shall not be used by Contractor to seek approval for proposed "or-equal" or substitute materials or equipment.

c. Engineer's review of or responses to RFIs will not constitute an approval, direction, or procedure related to the construction means, methods, techniques, sequences, or safety.

d. Responses to Contractor RFIs will not change any requirement of the Contract Documents. In the event Contractor believes that a response to an RFI will cause a change in the Contract Price or Contract Time, Contractor must promptly give written notice of the Claim to Engineer.

e. If Contractor wishes to make Claim for an adjustment of the Contract Price or an extension of the Contract Times, or both, written notice as provided in Paragraph 10.05 must be given and approved by Engineer before proceeding to execute the Work. Failure to give such written notice shall waive Contractor's right to seek an adjustment of the Contract Price or an extension of the Contract Times.

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B. *Resolving Discrepancies:*

Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of a Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

1. A Field Order;

2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or

3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or

2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation of such documents by Engineer.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for ordinary record keeping purposes.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify, defend, and hold harmless Engineer, and the Owner and their employees, principals, agents, successors, insurers, sureties and assigns, from and against any and all liabilities, claims, causes of actions, suits of any nature, fines, penalties, expenses, costs, losses, and damages (including but not

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limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of, resulting from, or relating to the unauthorized use, reuse, or modification of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or Engineer's consultants, including electronic media editions, by Contractor, its employees, agents, or any other person or entity for whom Contractor is legally liable.

3.06 *Electronic Data*

A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, which may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, surveys, graphics, or other types are furnished, if at all, only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. To the extent that any discrepancy exists between the electronic files and the hard copies, the hard copies shall govern.

   The Engineer may, but is not obligated to, make copies of requested Drawings in electronic format for the Contractor's convenience and to facilitate the Contractor's administration of the Project. Because information presented on electronic files can be modified, unintentionally or otherwise, the Engineer reserves the right to remove all indications of ownership from each electronic display. Notwithstanding the removal of indicia of ownership, the Engineer's copyright interest in such files and the information contained therein shall not be abridged or abated by such action. The use of electronic files prepared by the Engineer shall not in any way relieve the contractor of its duty to fully comply with the Contract Documents nor negate the Contractor's responsibility for coordination of other trades, and taking field measurements.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data. To the extent any errors are detected, the receiving party must provide written notice to the transferring party, who must correct the errors identified within the 60 day acceptance period.

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

A. Owner will furnish the Site. Owner will notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain, in a timely manner and pay for, easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the

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Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim as provided in Paragraph 10.05.

B. In the event the Project involves private land, upon reasonable written request, Owner will furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor must provide for all additional lands and access required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Contract Documents identify:

1. If during the preparation of these Contract Documents, subsurface or geotechnical explorations were conducted which are relevant in the discretion of the Engineer to the scope of the work, the findings will be included in the Appendix of the Specifications. The Contractor is responsible for obtaining reports and explorations it deems necessary and advisable for the performing of the Work in accordance with the Contract Documents.

2. Information and data reflected in the Contract Documents, with respect to existing structures and facilities at or contiguous to the Site, are based upon information obtained from varying sources which may include reports, drawings or other data of those facilities presently on file with the Owner. The Owner and Engineer do not guarantee the accuracy of any such information. The Contractor is responsible for field verifying all conditions and measurements and for determining the suitability of the site for the proposed Work.

B. *Limited Reliance by Contractor on Technical Data Authorized:* any reports and drawings which have been identified in Article 4.02 A 1 are not Contract Documents. However, in the event the Engineer specifically calls out and designates certain information in reports and drawings as "Technical Data" then Contractor has a limited right to rely upon the accuracy of the designated Technical Data. Other than the designated Technical Data, any information provided and depicted on the Drawings is merely intended to be a general representation of the physical conditions likely to be encountered during the Work and will not constitute a guarantee or warranty by the Engineer or Owner that actual conditions will not vary from what is depicted. Except for the Contractor's right to rely on the designated technical data, which is limited as more specifically shown below. Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, elected officials, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in reports or shown or indicated in drawings; or

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3. any Contractor interpretation of or conclusion drawn from any "technical data" or any other data, interpretations, opinions, or information.

4. the information provided and depicted on the project drawings is not guaranteed by the Owner or Engineer to be more than a general representation of the physical conditions likely to be encountered during the Work.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor discovers or should reasonably have discovered, or otherwise reasonably believes any subsurface or physical condition is uncovered or revealed:

1. is of such a nature as to establish any "Technical Data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate;

2. is of such a nature as to require a change in the Contract Documents;

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents, and is not in the area of the project bid as Unclassified Excavation,

then Contractor must, promptly, after becoming aware and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor may not further disturb the condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review*: After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

C. *Possible Price and Times Adjustments*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work, subject, however, to the following:

a. such circumstance must meet the conditions of Paragraph 4.03. A; and

b. with respect to Work paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.

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2. Contractor is not entitled to any adjustment in the Contract Price or Contract Times if:

a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

c. Contractor failed to give the written notice as required by Paragraph 4.03.A.

3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer, or any of their officers, elected officials, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any consequential damages, including but not limited to claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project, and Contractor expressly and specifically releases any and all damages related thereto. Any damages for suspension or idle time shall be limited to the Contractor's actual cost of labor or equipment costs, including a reasonable markup for overhead but shall not include a markup for profit.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Contract Documents:

1. Owner and Engineer are not responsible for the accuracy or completeness of any information or data provided; and

2. the cost of all of the following must be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all information and data;

b. locating all Underground Facilities shown or indicated in the Contract Documents;

c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and

d. the safety and protection of all Underground Facilities and repairing any damage resulting from the Work.

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B. *Not Shown or Indicated:*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor must, promptly after becoming aware and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment will be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim as provided in Paragraph 10.05.

3. Generally, service connections are not indicated on the project drawings. Contractor is responsible for locating all existing underground utility installations in advance of excavation.

C. *Underground Utility Damage Prevention Act:*

1. Contractor is required to and agrees to comply with all the provisions of any applicable underground utility damage prevention act (however titled) and hereby agrees, to the fullest extent permitted by Laws and Regulations, to indemnify, defend, and hold harmless Owner, Engineer, and their employees, elected officials, principals, agents, successors, sureties, insurers and assigns, including any of their Related Entities, if any, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to Contractor's failure, or the failure of anyone for whom Contractor is responsible, to so comply with the requirements of said act, except the Contractor is not required to indemnify any person or entity for acts attributable to the sole negligence of such person or entity.

4.05 *Reference Points*

A. Owner will provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor is responsible for laying out the Work, protecting and preserving the established reference points and property monuments. Contractor cannot make any changes or relocations without the prior written approval of Owner. Contractor must report to Engineer whenever any reference point or

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property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and is responsible for the accurate replacement or relocation of reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* Reference is made to the Contract Documents for the identification of those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, which have been utilized by the Engineer in the preparation of the Contract Documents.

B. *Limited Reliance by Contractor on designated Technical Data Authorized:* Contractor may rely upon the accuracy of any designated "Technical Data" contained in reports and drawings, but reports and drawings are not Contract Documents, and Contractor's reliance on the designated Technical Data is limited to the extent specifically described in set forth in Article 4.02 B. Except for reliance on "Technical Data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, elected officials, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in reports or shown or indicated in drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any other data, interpretations, opinions or information.

C. Contractor is not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor is responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

D. If Contractor encounters a Hazardous Environmental Condition, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor must immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner will promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

E. Contractor is not required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits and delivered written notice to

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Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim as provided in Paragraph 10.05.

F. If after receipt of written notice Contractor does not agree to resume Work based on a reasonable belief it is unsafe, or does not agree to resume Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim as provided in Paragraph 10.05. Owner may have the deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

H. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

A. Contractor must furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor must also furnish such other bonds as are required by the Contract Documents. The Owner is solely responsible for determining the adequacy and sufficiency of the bonds for the Project.

B. All bonds must be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and be executed by a surety named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of the individual's authority to bind the

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surety. The evidence of authority must show the bond is effective on the date the agent or attorney-in-fact signed each bond.

C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor must promptly notify Owner and Engineer and must, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor must be obtained from surety or insurance companies who are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits. Surety and insurance companies must also meet such additional requirements and qualifications provided in the Supplementary Conditions. The Owner is responsible for determining the sufficiency and adequacy of such bonds and insurance.

5.03 *Certificates of Insurance*

A. Contractor must deliver to Owner, with copies to each additional insured and loss payee identified in the Contract Documents, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain. The Owner is solely responsible for determining the adequacy and sufficiency of the insurance requested under the Contract Documents and any certificates of insurance which are required.

B. Owner will deliver to Contractor, with copies to each additional insured and loss payee identified in the Contract Documents, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.

C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with the insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor’s obligation to maintain insurance.

D. Neither Owner nor Engineer represents insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.

E. The insurance and insurance limits required shall not be deemed as a limitation on Contractor’s liability under the cap contract documents, including under the indemnities granted in the Contract Documents.

5.04 *Contractor’s Insurance*

A. Contractor must purchase and maintain insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from

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Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:

a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

b. by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting there from;

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle; and

7. claims for damages arising out of Contractor's performance or providing of professional architectural or engineering services in accordance with Paragraph 6.21.B.

B. The policies of insurance required by this Paragraph 5.04 must:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insured's (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Contract Documents, all of whom must be listed as additional insured's, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insured's, and the insurance afforded to these additional insured's shall provide primary coverage for all claims covered thereby;

2. include the specific coverages herein required or required by Laws or Regulations, whichever is greater;

3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;

4. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 60 days prior written notice has been

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given to Owner and Contractor and to each other additional insured identified in the Contract Documents to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);

5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and

6. include completed operations coverage:

a. Insurance must remain in effect for two years after final payment.

b. Contractor must furnish Owner and each other additional insured identified in the Contract Documents to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any additional insured of continuation of insurance at final payment and one year thereafter.

C. Satisfactory certificates of insurance must be submitted and attached to the executed Agreement for Construction between the Owner and Contractor. In connection with the provisions set forth in the Modified General Conditions, the Notice to Proceed will not be issued until certificates of insurance, satisfactory to Owner, are filed.

D. Specified Limits of Insurance Required to be Carried by Contractor

1. Worker's Compensation and Employer's Liability

The insurance must protect the Contractor and Owner and the Engineer against all claims under worker's compensation laws. The Contractor and Owner must also be protected against claims for injury, disease, or death of employees that, for any reason, may not fall within the provisions of a worker's compensation law. This policy must include an "all states" endorsement.

The liability limits must not be less than:
Worker's Compensation ..... Statutory
Employer's Liability ..... $500,000 each occurrence

2. Comprehensive Automobile Liability

The insurance must be written in comprehensive form and protect the Contractor and Owner and engineer against all claims for injuries to members of the public and damage to property of others arising from the use of motor vehicles, and cover operation on or off the site of all motor vehicles licensed for highway use, whether they are owned, non-owned, or hired.

The liability limits must not be less than:

Bodily Injury	$1,000,000 each person
	$1,000,000 each occurrence
Property Damage	$1,000,000 each occurrence
	$1,000,000 aggregate

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3. Comprehensive General Liability

   The insurance must be written in comprehensive form and protect the Contractor and Owner against all claims arising from injuries to persons other than its employees or damage to property of the Owner or others arising out of any act or omission of Contractor or its agents, employees, or Subcontractors. The policy must also include protection against claims insured by usual personal injury liability coverage and include a "protective liability" endorsement to insure the contractual liability assumed by the Contractor under the indemnification provisions in the Modified General Conditions, and "Completed Operations and Products Liability" coverage (to remain in force during the correction or warranty period required under this Agreement.

   To the extent the Contractor's work, or work under its direction, may require blasting, explosive conditions, or underground operations, the comprehensive general liability coverage must contain no exclusion relative to blasting, explosion, collapse of building, or damage to underground property.

Bodily Injury	$1,000,000 each person
	$1,000,000 each occurrence
Property Damage	$1,000,000 each occurrence
	$2,000,000 aggregate

4. Umbrella Liability Policy

   The insurance must protect the Contractor against all claims in excess of the limits provided under the worker's compensation and employer's liability, comprehensive automobile liability, and general liability policies. The liability limits of the umbrella liability policy must not be less than $5,000,000.

E. Contractor covenants and agrees the insurance coverage and limits required by the Contract Documents shall in no way be considered or used in any manner as a limit or cap of any kind on any liability or obligation Contractor may otherwise have, including, without limitation, liability under the indemnification provisions contained herein.

   1. by requiring insurance and insurance limits, neither Owner nor Engineer represents the coverage and limits will necessarily be adequate to protect Contractor.

   2. Contractor is responsible for any deductible or self-insured retention.

5.05 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance to protect Owner against claims which may arise from operations under the Contract Documents.

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5.06 *Property Insurance*

A. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 5.06 must contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 60 days prior written notice has been given to Owner and Contractor and to each other loss payee to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.

B. Owner is not responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts identified in the Contract Documents. The risk of loss within identified deductible amount must be borne by Contractor, Subcontractors, or others suffering any loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

5.07 *Waiver of Rights*

A. Owner and Contractor intend all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, elected officials, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All policies must contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees there under. Owner and Contractor waive all rights against each other and their respective officers, elected officials, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by policies and any other property insurance applicable to the Work; and, in addition, waive all rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, elected officials, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) under policies for losses and damages so caused. None of the above waivers extend to the rights that any party making the waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy issued. This Waiver of Subrogation must survive the completion or termination of this Agreement.

B. Owner, and Contractor waive all rights against each other, Subcontractors, and Engineer, and the officers, elected officials, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner, or any other loss of profits or other consequential damages; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property

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insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B must contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them. This provision must survive the completion and/or termination of the Agreement.

5.08 *Receipt and Application of Insurance Proceeds*

A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner as fiduciary for the loss payees, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner will deposit in a separate account any money so received and distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work must be repaired or replaced, the Monies received applied on account thereof, and the Work and the cost covered by an appropriate Change Order.

B. Owner as fiduciary has the power to adjust and settle any loss with the insurers unless one of the parties in interest objects in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If objection be made, Owner as fiduciary will make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no agreement among the parties in interest is reached, Owner as fiduciary will adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary will give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party must notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor must each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party fails to purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party must notify the other party in writing of the failure to purchase prior to the start of Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order will be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or

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occupancy may commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any necessary changes in coverage. The insurers providing the property insurance must consent by endorsement on the policy or policies, but the property insurance must not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

A. Contractor must supervise, inspect, and direct the Work competently and efficiently, devoting attention and applying skills and expertise necessary to perform the Work in accordance with the Contract Documents. The Contractor is solely responsible for the means, methods, techniques, sequences, and procedures of construction. The Contractor must supervise, inspect, and direct the Work competently and efficiently, devoting attention and applying skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

Contractor must provide competent, qualified, on-site, supervision at all times during construction activities including supervision of the activities of the sub-contractor(s), vendors and suppliers through a Resident Superintendent. The Resident Superintendent must be on-site at any time work is ongoing at the project. Sub-contractors shall not work independently on the project without on-site supervision provided Resident Superintendent. A resume for the Resident Superintendent must be submitted to the Engineer for approval prior to commencing work. Resumes must include projects they were in responsible charge of, are of similar work in scope and value with owner's references. Contractor must not change the Resident Superintendent without written approval from the Engineer. However, the approval of any supervisor by the Engineer does not relieve the Contractor of its obligation to properly supervise and perform the Work.

B. If at any point during the progress of the Work the Owner determines, in its sole discretion, the Resident Superintendent is inadequately performing its services, the Owner may direct in writing the Contractor to replace the Resident Superintendent within thirty (30) days of notification. The resumes of any proposed new Resident Superintendent must be submitted to the Engineer for approval prior to their commencement of work on the project.

1. The Resident Superintendent must provide Owner and Engineer with a written daily field report containing, as a minimum, the following information:

a. the number of personnel on site, identified by craft or trade, employer and work activity, and the number of hours worked during the workday;

b. the types and numbers of equipment on site and the time each piece of equipment was used or stood idle during the workday;

c. any materials or equipment received on site during the workday; and

d. the identification and quantity of any unit price work, if any, installed during the day.

The daily field reports must be submitted to Owner and Engineer at least weekly.

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C. For purposes of giving or receiving notices, directives, Change Orders, or any other information from Owner or Engineer to Contractor, Contractor must designate a specific individual as Project Manager to receive notices, directives, Change Orders, or other information. If the person designated by Contractor is not available, Contractor must (in writing addressed to Owner and Engineer) identify the individual who is acting as his authorized representative.

D. Contractor acknowledges its obligation to complete the Work in accordance with the Contract Documents shall not be affected or amended as a result of any act by Engineer or any other Owner's consultant, or as a consequence of any field inspections or observations or approval of any Application for Payment, or in regard to any other duty performed by Engineer or other Owner's consultant for the benefit of Owner, unless Owner and Engineer expressly approve Contractor's action in advance in writing specifically identifying the action approved. Furthermore, Contractor shall not be relieved of any responsibility to complete the Work in conformity with the contract Documents as a consequence of any knowledge of non-conformity obtained by an Owner's representative, including Engineer, whether or not such representative acts or fails to act on such knowledge. Contractor acknowledges and agrees that any representative retained by Owner to act for Owner's benefit, including Engineer, shall have no duty or responsibility to Contractor, except where specifically stated herein, and no act or failure to act by such Owner's representative shall relieve Contractor of its obligations to perform all requirements under this Contract, except as specifically approved in writing otherwise.

6.02 *Labor; Working Hours*

A. Contractor must provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor must, at all times, maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site must be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

C. No Work may be done between 6 p.m. and 7 a.m. without permission of Owner. However, emergency work may be accomplished without prior permission. No Night Work may be undertaken without permission of Owner.

D. Each occasion Contractor works in excess of 45 hours per week, or outside of the hours of 7:00 am and 6:00 pm, or on weekends or holidays, the Contractor must reimburse Owner for any and all costs and expenses (including, but not limited to, Engineer's fees and expenses associated with additional Observation and Contract Administration) incurred by Owner as a result of such schedule. Contractor covenants and agrees Owner may retain, deduct, and/or offset monies due to Owner pursuant to this Paragraph from monies due to Contractor under the Agreement. Contractor further covenants and agrees Owner retains the right to make such deduction or offset at any time prior to and including final payment and the imposition and the deduction and/or offset of such monies shall not be subject to any notice or claim provisions of the Contract Documents.

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6.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work must be as specified or, if not specified, be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications must expressly run to the benefit of Owner. If required by Engineer, Contractor must furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

1. To the extent possible, all warranties must run to and be enforceable by Owner. Contractor agrees to assign to Owner at the time of final completion of the Work, or as otherwise required by the Contract Documents, any and all Subcontractor and Supplier warranties relating to materials and labor used in the Work and Contractor further agrees to perform the Work in such a manner to preserve any and all Subcontractors' and Suppliers' warranties. Contractor must provide Owner assistance, throughout the duration of such warranties, in enforcing the obligations of Subcontractors and Suppliers. If necessary as a matter of law, Contractor may retain the right to enforce directly any such Subcontractors' and Suppliers' warranties during the one-year period following the date of Substantial Completion established by Paragraph 14.04. Contractor includes in this warranty materials and equipment specified by Engineer by brand name. The warranty provided in this Paragraph 6.03 shall be in addition to and not in limitation of any other warranty required by the Contract Documents or otherwise prescribed by law and be in addition to all other rights and remedies available to Owner. All warranty obligations are cumulative to and in addition to all remedies available to Owner pursuant to the Contract Documents and applicable law.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

D. Materials and equipment stored off site must be stored in a bonded, secure warehouse. Any materials and equipment stored off site must be available for review by Engineer's representative. Material and equipment must be stored and maintained while in storage in a manner consistent with the manufacturer's recommendations. Maintenance during storage, or prior to startup must be documented and presented to the Engineer. Risk of loss of stored materials and equipment must be on Contractor, whether titled in the name of the Contractor or whether title previously passed to the Owner as a result of payment for the stored materials and equipment.

E. The Contractor has responsibility for the care of all equipment and materials, including those furnished by the Owner, if any, and bears the risk of injury, loss, or damage to any part thereof by action of the elements or from any other cause, until final completion. Contractor must rebuild, repair, restore, and make good all injuries, losses, or damages to any portion of the Work or the equipment or materials occasioned by any cause before completion and acceptance of the Work and bears the expense therefore. Contractor, at no additional cost to Owner, provide

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temporary measures and suitable structures as might be necessary to protect the Work or any portion thereof from damage.

F. Suspension of the Work or the granting of an extension of time for any reason does not relieve Contractor of responsibilities for the Work as specified herein including the continuing care and maintenance of stored materials and equipment as well as work accomplished to date.

G. If the equipment furnished by the Contractor differs in dimension, orientation, horsepower requirements, pipe connection sizes, or is otherwise non-conforming to the Contract Documents, the Contractor is responsible for the furnishing of all properly-sized connecting piping, motor starters, motor controls, and electrical wiring and connections, and all other work required to properly install the equipment in complete operating condition. Further, such non-– conforming equipment or materials must be submitted as a "Substitute" in accordance with Section 6.05 of the Modified General Conditions, including and subject to Paragraph 6.05. E. *Engineer's Cost Reimbursement*. No additional compensation by the Owner to the Contractor will be made with respect to such "Substitutes".

6.04 *Progress Schedule*

A. Contractor must adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.

1. Contractor must submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Adjustments must comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule which change the Contract Times must be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

3. Contractor must submit to the Engineer an adjusted Progress Schedule whenever the progress of the Work is behind the current, approved Progress Schedule as defined in paragraph 2.07 1 of the Modified General Conditions, or upon the Engineer's request and whenever the Engineer determines in its discretion the Work cannot be substantially complete in the time remaining. The adjusted Progress Schedule must be submitted within ten (10) days of Engineer's written request and prior to the Contractor's next application for payment.

4. Owner has the right to direct a postponement or rescheduling of any date or time for the performance of any part of the Work that may interfere with the operation of Owner's premises or any tenants or invitees thereof. Contractor must, upon Owner's request, reschedule any portion of the Work affecting operation of the premises during hours when the premises are not in operation. Any postponement, rescheduling, or performance of the Work under this Paragraph 6.04.3 may be grounds for an extension of the Contract Times, if permitted under Article 12, and an equitable adjustment in the Contract Price, if permitted under Article 12 and (i) the performance of the Work was properly scheduled by the Contractor in compliance with the requirements of the Contract Documents and (ii) such rescheduling or postponement is required for the convenience of the Owner.

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6.05 *Substitutes and "Or-Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the Contract Documents contain a description followed by words reading "or an approved equivalent" or "or approved equal" item or "substitution is permitted," other items of material or equipment or material or equipment of other suppliers may not be submitted to Engineer for review. If the description contains or is followed by words reading "or an approved equivalent" or "or approved equal" item or "substitution is permitted," other items of material or equipment or material or equipment of other suppliers may be substituted to Engineer for review under the circumstances described below.

1. *"Or-Equal" Items* If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines:

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics; and

2) it will reliably perform at least equally well the function and achieve the results intended by the design concept of the completed Project as a functioning whole; and

3) it has a proven record of performance and availability of responsive service; and

4) it is equal or better in form, features, operation and maintenance cost and general configuration; and

5) it conforms to the requirements of the Contract Documents in all respects, except for make and manufacturer or supplier and minor details of specified equipment; and

b. Contractor certifies in writing, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items*

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a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. Contractor must submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefore. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.

c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances. Applications for approval of substitute items of material or equipment will not be accepted by the Engineer if made as part of a Shop drawing submittal. The application for use of substitute material or equipment must be made prior to the submission of a shop drawing by a written communication clearly labeled "Request for Substitution". Substitute items proposed by Shop Drawings for materials or equipment will be rejected by the Engineer unless previously approved in a separate application.

d. Contractor must make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

1) shall certify that the proposed substitute item will:

a) perform adequately the functions and achieve the results called for by the general design;

b) be similar in substance to that specified;

c) be suited to the same use as that specified; and

d) Contractor accepts the installation instructions, warranty and correction obligations contained in the product manufacturer's literature in connection with the proposed substitution as if such, information pertaining to the new product was originally specified in the Contract Documents; and

2) must state:

a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,

b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty; and

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3) will identify:

a) all variations of the proposed substitute item from that specified, and

b) available engineering, sales, maintenance, repair, and replacement services; and

4) contain an itemized estimate of all costs or credits which will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.

e. If a proposed substitution affects a correlated function, adjacent construction, or the work of other contractors, then the necessary changes and modifications to the affected work are considered an essential part of the proposed substitution, to be accomplished by Contractor as a part of the Work, if and when approved.

B. *Substitute Construction Methods or Procedures* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor must submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine the substitute proposed is equivalent to what is expressly called for by the Contract Documents. The requirements for review by Engineer must be similar to those provided in Paragraph 6.05.A.2.

C. *Engineer's Evaluation* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.

1. Proposed substitutions may be rejected without explanation and will not be considered unless one or more of the following conditions exists:

a. Required for compliance with interpretation of code requirements or insurance regulations then existing.

b. Unavailability of specified products, through no fault of Contractor.

c. Subsequent information discloses inability of specified products to perform properly or to fit in designated space.

d. Manufacturer/fabricator refuses to certify or guarantee performance or specified product as required.

e. When in the judgment of Owner or Engineer, a substitution would be substantially to Owner's best interests, in terms of cost, time, or other considerations.

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D. *Special Guarantee* Owner may require Contractor to furnish, at Contractor's expense, a special performance guarantee or other surety with respect to any substitute.

E. *Engineer's Cost Reimbursement* Contractor shall be liable to Owner for any and all costs and expenses (including, but not limited to, Engineer's fees and expenses) incurred by Owner as a result of evaluating a substitute proposed or submitted by the Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B, and reflecting changes in the Contract Documents, whether or not Engineer approves a substitute so proposed or submitted by Contractor. Contractor covenants and agrees that Owner may retain, deduct, and/or offset monies due to Owner pursuant to Paragraph 6.17.D.4 from monies due to Contractor under the Agreement. Contractor further covenants and agrees that Owner retains the right to make such deduction or offset at any time prior to and including final payment and that the imposition and the deduction and/or offset of such monies shall not be subject to any notice or claim provisions of the Contract Documents. Such payment is an obligation separate and apart from the Contractor's obligation to pay liquidated damages for delay, if any.

F. *Contractor's Expense* Contractor must provide all data in support of any proposed substitute or "or equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor will not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor will not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any Subcontractor, Supplier, or other individual or entity may be revoked on the basis of reasonable objection after investigation. Contractor must submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order issued. No acceptance by Owner of any Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, constitute a waiver of any right of Owner or Engineer to reject defective Work.

B. As part of the Bid or the Proposal, the Owner may require the identity of the Contractor's proposed Subcontractors and Suppliers of Equipment or Materials in order to better evaluate the Proposal or Bid. In the instance where identification of Suppliers is required, supply only one name per equipment or material item.

C. Contractor is solely responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Owner or Engineer may furnish to any such Subcontractor, Supplier, or other individual, entity, or

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organization, to the extent practicable, information about amounts paid to Contractor for Work performed. Nothing in the Contract Documents:

1. creates for the benefit of any Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any Subcontractor, Supplier or other individual or entity; nor

2. creates any obligation on the part of Owner or Engineer to pay or to see to the payment of any Monies due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. Contractor is solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

E. Contractor must require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.

F. The divisions and sections of the Specifications and the identifications of any Drawings does not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade. Owner and Engineer assume no responsibility for the overlapping or omission of parts of the Work by various Subcontractors or Suppliers in their subcontracts with the Contractor, as this is solely the Contractor's responsibility.

G. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insured's or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same. This Waiver of Subrogation provision shall survive the completion and/or termination of this Agreement.

H. As soon as possible, but in no case more than 30 days after receipt of the Notice of Award, and prior to the first application for payment, the Contractor must provide the Engineer with a list of sub-contractors along with the division of their work.

6.07 *Patent Fees and Royalties*

A. Contractor must pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others.

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B. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor must obtain and pay for all construction permits and licenses. Owner will assist Contractor, when necessary, in obtaining such permits and licenses. Contractor must pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner will pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

A. Contractor must give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer is responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor bears all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work are the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made as provided in Paragraph 10.05.

6.10 *Taxes*

A. Contractor must pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

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B. A certified sales tax statement must be provided with each and every pay application, even if there were no sales tax during the period.

6.11 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas:*

1. Contractor must confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor assumes full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor must promptly settle with such other party by negotiation or otherwise resolve the claim or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, elected officials, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

4. Only materials and equipment that are to be used directly in the Work can be brought to and stored on the Project site by Contractor. After equipment is no longer required for the Work, it must be promptly removed from the Project site. If Contractor uses any portion of the new Work prior to the date of Substantial Completion of the entire Work, items must be restored to their new condition.

B. *Removal of Debris during Performance of the Work* During the progress of the Work Contractor must keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of waste materials, rubbish, and other debris must conform to applicable Laws and Regulations.

C. *Cleaning* Prior to Substantial Completion of the Work Contractor must clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor must remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading Structures* Contractor must not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor will Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

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6.12 *Record Documents*

A. Contractor must maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction including, but not necessarily limited to, (i) deviations from the Drawings and Specifications made during construction; (ii) details in the Work not previously shown; (iii) changes to existing conditions or existing conditions found to differ from those shown on the Drawings; (iv) the actual installed position of all mechanical, electrical equipment, piping, ductwork, access panels, valves, drains, stub outs, etc.; and (v) such other information as Owner or Engineer may reasonably request. These record documents together with all approved samples and a counterpart of all approved Shop Drawings will be available to Engineer and Owner for reference. Contractor's Record Documents must be available for review by Engineer as part of the pay application process. A pay application will not be considered until the Record Documents are shown complete through that application period. Upon completion of the Work, these Record Documents, Samples, and Shop Drawings will be delivered to Engineer for Owner. Final payment and any retainage is not due and owing to Contractor until the Record Documents, marked by Contractor, as required above are delivered as required above.

6.13 *Safety and Protection*

A. Contractor is solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of its responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor must take all necessary precautions for the safety of, and provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor must comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and erect and maintain all necessary safeguards for such safety and protection. Contractor must notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and cooperate with them in the protection, removal, relocation, and replacement of their property.

C. Contractor must comply with the applicable requirements of Owner's safety programs, if any.

D. Contractor must inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

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E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and for protection of the Work must continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

G. Nothing contained in the Contract Documents shall be construed to require or authorize Engineer or Owner to supervise or be in any way responsible for Contractor's compliance with any applicable safety regulations, codes, or procedures. Engineer and Owner has no duty to inform the Contractor of any safety violations, and should Engineer or Owner voluntarily point out safety violations, such actions shall not be construed to mean that Engineer or Owner has assumed any responsibility for Contractor's compliance with any applicable safety regulations, codes, or procedures. Contractor is solely responsible for Project safety.

H. Contractor must promptly report in writing to Owner and Engineer all accidents arising out of or in connection with the Work that cause death, personal injury, or property damage, giving full details and statements of any witnesses.

6.14 *Safety Representative*

A. Contractor must designate a qualified and experienced safety representative at the Site whose duties and responsibilities be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

A. Contractor is responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor must give Engineer prompt written notice if Contractor believes any significant changes in the Work or variations from the Contract Documents have been caused or are required as a result thereof. If Engineer determines a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

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6.17 *Shop Drawings and Samples*

A. Contractor must submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07) and the submittal procedures described elsewhere in these Contract Documents. In the event of any conflict between the submittal procedures noted above and this Paragraph 6.17, the more stringent requirements control. Each submittal will be identified as Engineer may require. Contractor represents and warrants all Shop Drawings will be prepared by persons and entities possessing expertise and experience in the trade for which the Shop Drawing is prepared and, if required by the Contract Documents or applicable Laws or Regulations, be a licensed architect or engineer, as appropriate.

1. *Shop Drawings*

a. Submit number of copies specified in the General Requirements.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples*

a. Submit number of Samples specified in the Specifications.

b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal is at the sole expense and responsibility of Contractor.

C. *Submittal Procedures*

1. Before submitting each Shop Drawing or Sample, Contractor must have:

a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and related information;

c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

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d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs.

2. Each submittal must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of the submittal.

3. With each submittal, Contractor must give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice must be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. *Engineer's Review*

1. Engineer will provide timely review of Shop Drawings and Samples. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. Engineer's review is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance responsibility of Contractor as required by the Contract Documents. The review and approval of a separate item does not indicate approval of the assembly in which the item functions.

3. Except as otherwise expressly provided herein, Engineer's approval of any submittal shall not in any way be deemed to release Contractor from full responsibility for complete and accurate performance of the Work in accordance with the Contract Documents; neither shall such approval release Contractor from any liability imposed upon Contractor by any provision of the Contract Documents. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

4. Contractor acknowledges the processing of Shop Drawings and other submittals often requires extensive and time-consuming reviews by many individuals and the time required for such reviews are directly related to the clarity, completeness, and accuracy of such submittals. Contractor covenants and agrees Contractor's responsibilities include, but are

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not limited to, reviewing and coordinating each submittal with all other related or affected work and approving each submittal before submitting same to Engineer for approval. As a part of its Basic services to Owner, Engineer will review up to two submissions of all Contractor submittals required by the Contract Documents. However, if Engineer is required to:

a. review a third or subsequent submission of any submittal, or

b. review more than the number of copies of each submittal specified in the Contract Documents, or

c. review submittals in addition to those required by the Contract Documents, or

d. review submittals for proposed substitutions for previously approved items, then

Contractor is liable to Owner for any and all costs and expenses (including, but not limited to, Engineer's fees and expenses) incurred by Owner as a result thereof. Contractor covenants and agrees Owner may retain, deduct, and/or offset Monies due to Owner pursuant to this Paragraph 6.17.D.4 from monies due to Contractor under the Agreement. Contractor further covenants and agrees that Owner retains the right to make such deduction or offset at any time prior to and including final payment and the imposition and the deduction and/or offset of such monies shall not be subject to any notice or claim provisions of the Contract Documents. Contractor acknowledges this obligation is separate and apart from the obligation to pay liquidated damages for delay, if any.

E. *Resubmittal Procedures:*

1. Contractor must make corrections required by Engineer and return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor must direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

F. *Professional Certification:*

1. When professional certification of performance criteria of materials, systems, or equipment is required by the Contract Documents, Contractor must provide the person or party providing the certification with full information on the relevant performance requirements and on the materials, systems, or equipment which are expected to operate at the Project site. The certification must be based on performance under the operating conditions generally prevailing or expected at the Project site. Engineer is entitled to rely upon the accuracy and completeness of such certification.

6.18 *Continuing the Work*

A. Contractor must carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work may be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing. Contractor's refusal or failure to continue with the Work in a timely manner as a result of any dispute that arises will constitute a material breach of the

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Agreement. Owner is entitled to specific performance of provisions requiring delivery of warranties and other required documentation.

6.19 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors are entitled to rely on representation of Contractor's warranty and guarantee. Unless otherwise stipulated elsewhere within the Contract Documents, the Contractor's warranty period will begin at Owner's acceptance and remain in effect for a period of 12 months. If an equipment or material failure occurs during the Contractor's warranty period, the Contractor's warranty period shall be extended by a period of time, equal to the down time of the equipment, or time until the material failure was corrected to the Owner's satisfaction.

B. Contractor's warranty and guarantee excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work which is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment by Owner;

4. use or occupancy of the Work or any part by Owner;

5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

6. any inspection, test, or approval by others; or

7. any correction of defective Work by Owner.

6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, Contractor and Subcontractor(s) (the "Indemnitors") shall indemnify and hold harmless Owner and Engineer, and the officers, elected officials, directors, members, partners, employees, insurers, agents, consultants and subcontractors of each and any of them (the "Indemnitees") from and against all claims, costs,

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losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of, resulting from, or relating to the Contractor's or its employees', agents' or Subcontractors' (or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable) actions, activities or omissions, negligent or otherwise, or breach or failure to perform this Agreement on or near Owner's property or easement, or arising in any way out of, resulting from, or relating to any of the Work to be performed under this Contract, including, without limitation, claim for bodily injuries, sickness, disease, or death, or to injury to or destruction of tangible property, or other economic damages such as fines, penalties, or other losses, including the loss of use resulting therefrom, except such obligation shall not require indemnity in favor of any party whose negligence solely caused such loss. To the extent any portion of this provision is deemed contrary to law or to otherwise be unenforceable, the parties agree such offending portion or portions be severed from this provision and the remaining provisions shall be enforceable to the maximum extent permitted at law. In the event of any conflict in the construction of this provision, the parties agree the interpretation requiring the fullest obligation and indemnity shall prevail.

B. In any and all claims against Owner or Engineer or any of their officers, elected officials, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, and Contractor expressly waives any right to any such limitation. Contractor must include in any and all subcontracts a provision requiring each Subcontractor to likewise waive any limitation on amount or type of damages, compensation, or benefits payable for or to the Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. Contractor's indemnity obligations under this Paragraph 6.20 shall also specifically include, without limitation, all fines, penalties, damages, liability, costs, expenses (including, but not limited to, reasonable fees and charges of engineers, architects, attorneys, and other professionals, and all court or mediation or other dispute resolution costs), and punitive damages (if any) arising out of, or in connection with, any (i) violation of or failure to comply with any law, statute, ordinance, rule, regulation, code, or requirement of a public authority that bears upon the performance of the Work by Contractor, a Subcontractor, or any person or entity for whom either is responsible, specifically including, but not limited to, any violations of the federal Occupational Safety and Health Act (as applied in the state in which the Project is located or any of the Work is performed) or the safety requirements under Article 6 of these Modified General Conditions; (ii) means, methods, procedures, techniques, or sequences of execution or performance of the Work; and (iii) failure to secure and pay for permits, fees, approvals, licenses, and inspections as required under the Contract Documents, or any violation of any permit or other approval of a public authority applicable to the Work, by Contractor, Subcontractor, or any person or entity for whom either is responsible.

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D. Contractor shall indemnify and hold harmless all of the Indemnities from and against any and all costs and expenses (including, but not limited to, reasonable fees and charges of attorneys) incurred by any of the Indemnities in enforcing any of Contractor's defense, indemnity, and hold-harmless obligations under this Contract.

E. No contention by Contractor that a certain claim is beyond its indemnity obligations herein required shall relieve Contractor of the obligation to provide indemnity until final judgment by a court of competent jurisdiction holding that there exists no duty on the part of Contractor to undertake any indemnity obligation under the circumstances of any particular claim.

6.21 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures or safety precautions and programs in connection with the Work.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer must specify all performance and design criteria of which the Owner and Engineer have knowledge that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional, whom comply with reasonable requirements of the Owner regarding qualifications and insurance. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, must bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer are entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria of which the Owner and Engineer have knowledge that such services must satisfy.

D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

E. (Intentionally deleted)

6.22 *Owner-Purchased Material and Equipment*

A. Contractor accepts assignment of, and liability for, all purchase orders and other agreements for procurement of Owner-purchased materials and equipment identified as part of the Contract Documents, if any. Contractor is responsible for any such pre-purchased items as if Contractor were the original purchaser. The Contract Price must include, without limitation, all costs and

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expenses in connection with delivery, handling, storage, insurance, installation, and testing of items covered in any assigned purchase orders or agreements. All warranty and correction of the Work obligations under the contract documents must also apply to any pre-purchased items, unless the Contract Documents specifically provide otherwise.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts, or have other work performed by utility owners that does not unreasonably interfere with Contractor's Work.

B. Contractor must afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor must do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with other work. Contractor must not endanger any work of others by cutting, excavating, or otherwise altering work; provided, however, Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor must inspect other work and promptly report to Engineer in writing any delays, defects, or deficiencies that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to report will constitute an acceptance of the work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies.

7.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following must be set forth in Contract Documents:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors;

2. the specific matters to be covered by such authority and responsibility must be itemized; and

3. the extent of authority and responsibilities must be provided.

B. Unless otherwise provided in the Contract Documents, Owner has sole authority and responsibility for coordination.

7.03 *Legal Relationships*

A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

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B. (Intentionally deleted)

C. Contractor is liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

7.04 *Claims between Contractors*

A. Should Contractor cause damage to the Work or property of any other contractor at the Site, or should any claim arising out of Contractor's performance of the Work at the Site be made by any other contractor against Contractor, Owner, Engineer, or the construction coordinator, Contractor must promptly attempt to settle with such other contractor by agreement, or to otherwise resolve the dispute by arbitration or at law.

B. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify, defend, and hold harmless Owner and its officers, elected officials, directors, partners, employees, agents, consultants, and subcontractors from and against all liabilities, claims, causes of action, suits of any nature, fines, penalties, expenses, costs, losses, and damages (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals and court costs) arising directly, or, indirectly, out of any controversy arising between Contractor any other contractor oversight, including, without limitation, any action, legal or equitable, brought by any other contractor against Owner to the extent said claim is based on or arises out of Contractor's performance of the Work. Should the presence of another contractor at the Site give rise to any other Claim, Contractor agrees its sole remedy with respect to such claim shall be against the of the contractor and Contractor agrees it shall not institute any action, legal or equitable, against owner or its officers, elected officials, directors, partners, employees, agents, consultants, and subcontracts, or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any arbiter, which seeks to impose liability on or to recover damages from Owner or its officers, elected officials, directors, partners, employees, agents, consultants, and subcontractors on account of any such damage or Claim.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

Except as otherwise provided in these Modified General Conditions, Owner will issue all communications to Contractor through Engineer.

8.02 *Replacement of Engineer*

In case of termination of the employment of Engineer, Owner will appoint an engineer, whose status under the Contract Documents will be that of the former Engineer.

8.03 *Furnish Data*

Owner will promptly furnish the data required of Owner under the Contract Documents.

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8.04 *Pay When Due*

Owner will make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

Owner's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

8.06 *(Intentionally deleted)*

8.07 *Change Orders*

Owner will execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

The Owner will not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner is not responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *(Intentionally deleted)*

8.12 *(Intentionally deleted)*

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents and will not be changed without written consent of Owner and Engineer. Except for those responsibilities of the Engineer to decide matters in dispute between the Owner and contractor, the Engineer's services are being performed solely for

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Owner's benefit, and no other party or entity shall have any claim against Engineer because of the performance or non-performance of such services.

9.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work. No act, omission, or observation of the Engineer will relieve the Contractor of its primary obligation to perform Work in strict accordance with the Contract Documents. No deviation from the Contract Documents will be deemed conforming Work unless documented in a written Change Order signed by all Parties, except for minor deviations which may be addressed by Field Orders as set forth below.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Construction Field Representative (CFR)*

A. Engineer may furnish a CFR to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any CFR and assistants will be as provided in the Contract Documents, and limitations on the responsibilities will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations of any other individual or entity will be as provided in the Contract Documents.

B. Limitations of Authority: Contractor cannot rely on the CFR in performing any of the following unless Contractor first receives written instructions of the Engineer. In addition, CFR may not:

1. undertake any of the responsibilities of the Contractor, the Subcontractors, or the Contractor's superintendent;

2. authorize any deviation from the Contract Documents;

3. stop Work;

4. expedite the work for the Contractor;

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5. advise on, or issue directions relative to, any aspect of the means, methods, techniques, safety, sequences, or procedures of construction;

6. authorize the Owner to occupy the Project in whole or in part;

7. participate in the performance of specialized field or laboratory tests.

9.04 *Authorized Variations in Work*

Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who must perform the Work involved promptly. If Owner or Contractor believes a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

Engineer has authority to reject Work which Engineer believes to be defective, or believes will not produce a completed Project which conforms to the Contract Documents or will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer also has authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

A. In connection with Engineer's authority and limitations as to Shop Drawings and Samples, see Paragraph 6.17.

B. In connection with Engineer's authority and limitations as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.

D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on matters before rendering a written decision (by recommendation of an Application for Payment or otherwise). Engineer's written decision is final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

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9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work. All matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, must be referred initially to Engineer in writing within 21 days of the event giving rise to the question in accordance with the provisions of Paragraph 10.5 with a request for formal decision.

1. In connection with Contractor's responsibilities with respect to requests for information (RFIs), see Paragraph 3.03.A.2.a and 3.03.A.2.b.

B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision will be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

C. Engineer's written decision with respect to any Claim will be a condition precedent to any exercise of rights or remedies a party may have under law.

D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision unless either party proves, by the preponderance of the evidence, that Engineer's decision was made arbitrarily and capriciously, with no evidence whatsoever to support Engineer's decision.

9.09 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them. As a condition of the Contractor accepting the right to perform the Work required under this Agreement, the Contractor on behalf of itself, its subcontractors, employees, sureties, and assigns does prospectively release any such claim as to Engineer and Contractor agrees its sole remedy shall be under the Contract to request additional time and compensation from the Owner in strict accordance with the provisions of this Agreement.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer is not responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer is not responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work. Neither the

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professional activities of Engineer, nor the presence of Engineer or its employees or consultants at the Project site, relieves Contractor of its obligations, duties, and responsibilities under the Contract Documents.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally the content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 also apply to the Construction Field Representative, and assistants, if any.

9.10 *(Intentionally deleted)*

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor must promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided). A change in the Contract Price or the Contract Times must be by a written Amendment, a written Change Order, or a written Work Change Directive. Contractor waives the right to additional compensation or time unless it first obtains such documents, properly executed by the appropriate parties, prior to performing any additional Work. No course of conduct or dealings between the parties, no expressed or implied acceptance of alterations or additions to the Work, and no claim that Owner has been unjustly enriched by any alterations or additions to the Work can be the basis of any claim for an increase in any amount due under the Contract Documents or a change in any time period provided for in the Contract Documents unless written documentation is obtained, as written documentation is a condition precedent to the Contractor's recovery of additional money or time.

B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

Contractor is not entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed unless required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

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10.03 *Execution of Change Orders*

A. Owner and Contractor must execute appropriate Change Orders recommended by Engineer covering:

1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A, or otherwise nonconforming work or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any Change Order, an appeal may be taken from any decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any appeal, Contractor must carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

B. Agreement on any Change Order constitutes a full and final settlement of all matters relating to the change in the Work that is the subject of the Change Order, including, but not limited to, all direct and indirect (including without limitation delay, disruption, impact, loss of efficiency, and extended overhead) costs associated with such change, or the cumulative effect of changes through the date of the subject Change Order, and any and all adjustments to the Contract Price and the Contract Times. Implied in every Change Order, unless expressly reserved by Owner or Contractor, is a waiver of all known and unknown claims arising out of or otherwise associated with the Change Order, including a waiver of an applicable federal or state anti-claim waiver statute or common law principal of similar effect. In the event a Change Order increases the Contract Price, Contractor must include the Work covered by the change Order in Applications for Payments as if the Work were originally part of the contract Documents.

10.04 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change. Owner has the responsibility of enforcing this provision.

B. Contractor must keep the surety informed of the progress of the Work, and, where necessary, obtain the surety's consent to, or waiver of, (i) notice of changes in the Work; (ii) request for reduction or release of retention; (iii) request for final payment; and/or (iv) any other item required by the surety. Owner must be notified by Contractor and be copied, in writing, with all communications between the Contractor and the surety. Owner may, in Owner's sole discretion, inform the surety of the quality and progress of the Work and obtain consents as necessary to protect Owner rights, interest, privileges, and benefits under and pursuant to any bond issued in connection with the Work.

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10.05 *Claims*

A. *Engineer's Decision Required* All Claims, except those waived pursuant to Paragraph 14.09, must be referred to the Engineer for decision. A decision by Engineer is required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect to Claims.

B. *Notice* Written notice stating the general nature of each Claim must be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 21 days) after the start of the event giving rise thereto; provided, however, that the claimant must use its best efforts to furnish Engineer and the other party, as expeditiously as possible, with notice of any Claim including, without limitation, those in connection with concealed or unknown conditions, once such Claim is recognized, and cooperate with Engineer and the party against whom the Claim is made in any effort to mitigate the alleged or potential damages, delay, or other adverse consequences arising out of the condition that is the cause of such a Claim. The responsibility to substantiate a Claim rests with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data must be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event in writing (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price must be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times must be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim must be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of the event. The opposing party must submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal in writing (unless Engineer allows additional time).

C. *Engineer's Action* Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

    1. deny the Claim in whole or in part;

    2. approve the Claim; or

    3. notify the parties the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

D. In the event Engineer does not take action on a Claim within 30 days, the Claim shall be deemed denied.

E. Engineer's written action under Paragraph 10.05. C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D is final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

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1. The notice required by Paragraph 10.05.B is a condition precedent to the assertion of any claim by Contractor. The right of Owner to receive written notice of claims under Paragraph 10.05.B may not be waived or modified by Owner or Engineer except in writing signed by Owner, and Contractor waives the right to rely on any purported waiver of this written notice by verbal instructions or other conduct of Owner or Engineer.

2. Contractor's written notice of a Claim must be made by written request seeking a Change Order and specifying the grounds and the relief sought. Contractor must attach to each Application for Payment a schedule of outstanding and unresolved Contractor Claims. By attaching and submitting the schedule with its Application for Payment, Contractor is deemed to have certified the only outstanding and unresolved Claims of which it has notice at the time of the Application for Payment are those identified in the schedule attached to its Application for Payment. A schedule of outstanding and unresolved requests for change orders and claims is required of each Subcontractor submitting an application for payment to Contractor that is to be included in Contractor's Application for Payment to Owner. Owner and Engineer must each rely upon Contractor's schedule of outstanding and unresolved Claims as inclusive of any and all Claims Contractor is then on notice of, and Contractor's acceptance of payment in response to an Application for Payment constitutes a waiver and release of any and all Claims not identified in Contractor's schedule of outstanding and unresolved Claims not identified in Contractor's schedule accompanying Application for Payment. Contractor must require each Subcontractor waive and release any and all requests for change orders and claims the Subcontractor is on notice of at the time it submits its application for payment to Contractor and which is not identified in its application for payment by acceptance of payment from Contractor.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

A. *Costs Included* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as agreed to in writing by Owner, costs shall be in amounts no higher than those prevailing in the locality of the Project, can not include any of the costs itemized in Paragraph 11.01.B, and are limited to the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Employees include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work must be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which includes social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay. The expenses of performing Work outside of regular working hours, on Saturday,

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Sunday, or legal holidays, must be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage, and Suppliers' field services. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment accrue to Owner, and Contractor must make provisions so they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor must obtain competitive bids from subcontractors acceptable to Owner and Contractor and deliver bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides Subcontractor be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work, but only to the extent authorized and approved by Owner in writing before such charges and expenses are incurred.

5. Supplemental costs include the following:

a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal. All costs must be in accordance with the terms of the rental agreements. The rental of any equipment, machinery, or parts must cease no longer necessary for the Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

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f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses must include settlements made with the written approval of Owner. No losses, damages, or expenses may be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance Contractor is required to purchase and maintain pursuant to the Contract Documents.

B. *Costs Excluded* The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

C. *Contractor's Fee* When all the Work is performed on the basis of cost-plus, Contractor's fee is determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee is determined as set forth in Paragraph 12.01.C.

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D. *Documentation* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor must establish and maintain records in accordance with generally accepted accounting practices and submit, in a form acceptable to Engineer, an itemized cost breakdown together with supporting data.

11.02 *Allowances*

A. Contractor will inlcude in the Contract Price all allowances named in the Contract Documents and cause the Work covered to be performed for the sums and by the persons or entities acceptable to Owner and Engineer.

B. *Cash Allowances*

1. Contractor agrees:

a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance:*

Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued, as recommended by Engineer, to reflect actual amounts due Contractor on account of Work covered by allowances and the Contract Price will be correspondingly adjusted.

11.03 *Unit Price Work*

A. Where the Contract Documents provide all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as stated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Unless otherwise stipulated in the Contract Documents, for Unit Price Work, Contractor shall be paid an amount equal to the sum of the unit price for each separately identified item of Unit Price

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Work times the actual quantity of each item as determined by the Engineer pursuant to paragraph 9.07. Variations between the actual quantity and the estimated quantity for items of Unit Price Work, including increases and decreases in quantities, as a result of any Change Orders, shall not serve as a basis for an adjustment in the unit price of the item.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price must be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

If Owner is entitled to reimbursement or payment from Contractor under or pursuant to the Contract Documents, payment must be made promptly to Owner. Notwithstanding anything contained in the Contract Documents to the contrary, if Contractor fails to promptly make any payment due Owner, or Owner incurs any costs and expenses to cure any default of Contractor or to correct defective Work, Owner has the absolute right to offset the amount against the Contract Price and may, in Owner's sole discretion, elect either to (1) deduct an amount equal to what Owner is entitled from any payment due Contractor from Owner, including payment of retainage, or (2) issue a written notice to Contractor reducing the Contract Price by an amount equal to what Owner is entitled.

B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to new unit prices or a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

C. *Contractor's Fee* The Contractor's fee for overhead and profit is determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

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a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee is 15 percent;

b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee is 5 percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is the Subcontractor who actually performed the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by the Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of 5 percent of the amount paid to the next lower tier Subcontractor;

d. no fee will be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

e. where Work is deleted from the Contract prior to commencement of the Work without substitution of other similar Work, one hundred percent (100%) of the Contract cost attributable to the Work, plus a Contractor's markup of ten percent (10%) on the amount of deleted cost, will be deducted from the Contract Price. However, in the event material submittals have been approved and orders placed for the materials, a lesser amount equal to the greater of (i) one hundred percent (100%) of the Contract cost attributable to the deleted Work, minus reasonable order cancellation, material restocking, and similar fees, plus a Contractor's fee of five percent (5%) on the amount of deleted cost, or (ii) eighty percent (80%) of the Contract Price will be deducted from the Contract Price. The credit to the Owner as a result of deletions in the work which results in a for reduced premiums on labor and material bonds, payment and performance bonds shall in all cases be one hundred percent (100%) of the reduction in premium. When both additions and credits are involved in any one change, the adjustment in Contractor's fee will be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

f. To the extent the Owner performs work as a result of any omission or breach of the Contractor, the Owner is entitled to an overhead mark-up consistent with the provisions in this section.

12.02 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times must be based on written notice submitted by the party making the Claim to the Engineer, and the other party to the Contract, in accordance with the provisions of Paragraph 10.05.

B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

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12.03 *Delays*

A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times may be extended in an amount equal to the time lost due to the delay if a Claim is made as provided in Paragraph 12.02.A and if the performance of the Work is not, was not, or would not have been delayed by any other cause for which the Contractor is not entitled to an extension of the Contract Times under the Contract Documents. Delays beyond the control of Contractor include, but are not limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God. Contractor acknowledges and agrees that adjustments in the Contract Times will be permitted for a delay only to the extent such delay (i) is not caused, or could not have been anticipated, by Contractor; (ii) could not be limited or avoided by the Contractor's timely notice to Owner of the delay or reasonable likelihood that a delay will occur; and (iii) is of a duration not less than one day. In no event will claims for delay be allowed where alleged delays do not impact the critical path of the Contractor as demonstrated on the relevant schedule provided by the Contractor for the period of time in which the delay allegedly occurred.

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor is entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor is entitled to an equitable adjustment in Contract Times, if the adjustment is essential to Contractor's ability to complete the Work within the Contract Times. An adjustment is Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

1. If a claim is made, as provided in Paragraph 12.03.A, and this Paragraph 12.03.C for delay due to abnormal weather conditions, the time extension to be awarded to Contractor, if any, will be calculated using the following standard baseline ("standard Baseline") of monthly anticipated adverse weather delay days for the project location, and extensions will only be granted for days lost in any given month in excess of the number of days shown in the Standard Baseline for the same given month. The Standard baseline will be regarded as the established normal and anticipatable number of calendar days for each month during which construction activity is expected to be prevented and suspended by cause of adverse weather. Suspension of construction activity for the number of days each month as listed in the Standard Baseline must be included in the Contractor' scheduling of weather-dependent activities and will not be eligible for extension of Contract Time.

Monthly Contract Allowance (MCA) in days												
Month	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**
Days	**8**	**6**	**6**	**7**	**5**	**8**	**7**	**5**	**6**	**3**	**5**	**7**

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2. Adverse Weather is defined as the occurrence of one or more of the following conditions which prevents exterior construction activity or access to the site within twenty-four (24) hours:

    a. Precipitation (rain, snow, and/or ice) in excess of two-tenths inch (0.20") liquid measure.

    b. Standing Snow in excess of one inch (1.00")

3. Adverse Weather may include, as deemed by Engineer, "dry-out" or "mud" days:

    a. For rain days above the standard baseline,

    b. Only if there is a hindrance to site access or site work such as earthwork; and,

    c. At a rate no greater than one (1) make-up day for each day or consecutive days of rain beyond the standard baseline totaling one inch (1.00") or more, liquid measure, unless specifically recommended otherwise by Engineer.

4. Actual adverse weather delay days must prevent work on critical exterior activities for fifty percent (50%) or more of Contractor's scheduled workday. The number of actual adverse weather delay days will be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather days exceeds the number of days anticipated by the Standard Baseline in Paragraph 12.03.C.1, and providing all other contractually-required conditions are met, qualifying delays will be converted to calendar days and additional calendar days will be added to the Contract times for each qualifying delay in excess of the Standard Baseline.

5. Upon commencement of on-site activities and continuing throughout construction, Contractor is responsible for accurately measuring and recording the daily the occurrence of adverse weather on-site.

6. Within 30 days of the last day of any month (hereinafter referred to as the "Reporting Month"), Contractor must submit a written Adverse Weather Report, including copies of Contractor's daily weather reports and applicable climatological data from the National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location, unless Engineer allows an additional period of time for submission of the report. Notwithstanding any other provisions, failure to submit the required written report within the time specified above will be deemed to be and constitute a waiver by Contractor of any and all claims for delay due to adverse weather conditions occurring during Reporting Month.

D. Owner, Engineer, and their officers, elected officials, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project. Time extensions due to weather delay shall not entitle Contractor to any claim, compensation, or recovery for extended overhead.

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E. Contractor is not entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier will be deemed to be delays within the control of Contractor.

F. Contractor is liable to Owner and must pay Owner for a percentage of all costs incurred by Owner and Engineer in investigating, analyzing, negotiating, arbitrating, and litigating any claim against Owner or Engineer for costs or damages due to any alleged delaying of Contractor in the performance of the Work, which percentage will be equal to the percentage of Contractor's total delay claim which is determined to be false or to have no basis in law or in fact.

G. To the fullest extent permitted by law, and notwithstanding anything to the contrary in the Contract Documents, an extension of the Contract Time, to the extent permitted under Paragraph 12.02, shall be the sole remedy of Contractor for any (1) delay in the commencement, prosecution, or completion of the Work, (ii) hindrance or obstruction in the performance of the Work, (iii) loss of productivity, or (iv) other similar claims (collectively referred to in this Paragraph 12.03.G as "Delays" whether or not such Delays are foreseeable, unless a Delay is caused by acts of Owner constituting active interference with Contractor's performance of the Work, and only to the extent such acts continue after Contractor furnishes Owner with notice of such interference. In no event shall Contractor be entitled to any compensation with any Delay, including, without limitation, consequential damages, lost opportunity costs, impact damages, or other similar remuneration. Owner's exercise of any of its rights under the Contract Documents (including, without limitation, ordering changes in the Work, or directing suspension, rescheduling, or correction of the Work), regardless of the extent or frequency of Owner's exercise of such rights or remedies, shall not be construed as active interference with Contractor's performance of the Work.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for observation, inspection, and testing. Contractor must provide proper and safe conditions for access and advise them of Contractor's safety procedures and programs so they may comply as applicable.

13.03 *Tests and Inspections*

A. Contractor must give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and cooperate with inspection and testing personnel to facilitate required inspections or tests.

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B. Owner will employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;

2. costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B and paid as provided in Paragraph 13.04.C; and

3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of the public body, Contractor must assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor is responsible for arranging and obtaining and paying all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase for incorporation in the Work. Inspections, tests, or approvals must be performed by organizations acceptable to Owner and Engineer.

E. If any Work (or the work of others) is to be inspected, tested, or approved and is covered by Contractor without written concurrence of Engineer, Contractor must, if requested by Engineer, uncover such Work for observation.

F. Uncovering Work as provided in Paragraph 13.03.E is at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover and Engineer has not acted with reasonable promptness in response to notice.

G. Contractor is responsible for inspection of portions of the work already performed to determine which portions are in proper condition to receive subsequent Work. Contractor must maintain an adequate inspection system and perform inspections to ensure the Work conforms strictly to the Contract requirements. Contractor must keep full and detailed inspection records and Owner and Owner's authorized representatives must be afforded access to, and be permitted to audit and copy, Contractor's inspection records relating to the Project. Contractor must preserve these records for a period of five years after final payment or for such longer period of time as may be required by law.

13.04 *Uncovering Work*

A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.

B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, must uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, the portion of the Work in question, furnishing all necessary labor, material, and equipment.

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C. If it is found that the uncovered Work is defective, Contractor must pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others). Owner will be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim as provided in Paragraph 10.05.

D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefore as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, or if the Work interferes with the operation of the existing facility, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for the order has been eliminated. However, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

A. Promptly after receipt of written notice, Contractor must correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor must pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others). Retesting which is necessary as a result of failed testing or defective work will be at the Contractor's expense.

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor cannot take action that would void or otherwise impair Owner's special warranty and guarantee, if any, on the Work.

C. At any time during the progress of the Work and up to the date of final acceptance, the Engineer has the right to reject any Work which does not conform to the requirements of the Contract Documents, even though the Work has been previously inspected and paid for. Any omissions or failure on the part of the Engineer to disapprove or reject any Work or materials at the time of inspection shall not be construed as an acceptance of any defective Work or materials.

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13.07 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. repair such defective land or areas; or

2. correct such defective Work; or

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) must be paid by Contractor.

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for the item may start to run from an earlier date if provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period with respect to such Work will be extended for an additional period of one year after the correction or removal and replacement has been satisfactorily completed.

E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor must pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective

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Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner is entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work accepted. If the parties are unable to agree as to the amount, Owner may make a Claim therefore as provided in Paragraph 10.05. If the acceptance occurs after a recommendation, an appropriate amount must be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

A. If Contractor fails, within a reasonable time after written notice from Engineer, to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 13.09, Owner will proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor must allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order issued incorporating the necessary revisions in the Contract Documents with respect to the Work. Owner will be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim as provided in Paragraph 10.05. Claims, costs, losses and damages include but are not limited to, all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work and the Owner's expenses and compensation for the Engineer's additional services made necessary by Contractor's default, neglect, or failure. Contractor covenants and agrees Owner may retain, deduct, or offset Monies due to Owner pursuant to this Paragraph 13.09.C from Monies due to Contractor under the Contract Documents. Contractor further covenants and agrees Owner retains the right to make such reduction or offset at any time prior to and including final payment and the imposition and the deduction and/or offset of Monies is not subject to any notice or Claim provisions of the Contract Documents.

D. Contractor will not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

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ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

A. The Schedule of Values established in Paragraph 2.07 serves as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

B. Detail Breakdown of Contract Amount except in cases where unit prices form the basis for payment under the Contract, the Contractor must, in accordance with Paragraph 2.07.3, submit a complete itemization of the Contract Amount showing the value assigned to each part of the work, including an allowance for profit and overhead. Upon approval of the itemization of the Contract Amount by the Engineer, it will be used as the basis for all Applications for Payment.

14.02 *Progress Payments*

A. *Applications for Payment*

1. At the date established for each progress payment (but not more often than once a month), Contractor must submit to the Engineer an Application for Payment for Work done and materials delivered and stored on the Site. Each Application for Payment must be computed on the basis of Work completed on all items listed in the Detail Breakdown of Contract Amount (or on unit prices), less retainage. The Contractor must furnish the Engineer and Owner all reasonable information required for obtaining the necessary data relative to the progress and execution of the Work. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or another location agreed to in writing, the Application for Payment must be accompanied by evidence the materials and equipment are covered by appropriate property insurance, all of which must be satisfactory to the Owner.

2. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments is governed by N.C. General Statute 143-134.1.

4. Payment for Stored Materials and Equipment The following conditions apply to payment for stored materials and equipment allowed by Article 14.02.A.1.:

a. Except in the instance of a material or equipment item that involves little or no installation cost, payment for stored materials or equipment must not exceed fifty percent (50%) of the value of the item on the Schedule of Values (for lump sum contracts) or fifty percent (50%) of the value the pay item (for unit price contracts) which covers the materials or equipment being claimed. For material or equipment items that involve little or no installation cost, the percentage of the value of the item that will be paid for stored materials will be as agreed upon by the Engineer, Owner, and Contractor.

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b. Contractor must submit paid invoices or releases of Lien from the stored materials and equipment suppliers with each Application for Payment containing a request for payment for that particular item of stored materials or equipment.

c. Payment for stored materials and equipment is generally intended to apply only to major materials and equipment items, as determined by the Engineer.

5. Each Application for Payment must be accompanied by the following, all in form and substance in accordance with the Contract Documents and satisfactory to Owner:

a. In accordance with Paragraph 10.05.F.2, a current schedule of outstanding and unresolved Contractor Claims;

b. A current Contractor's lien waiver and duly executed and acknowledged sworn statement showing all Subcontractors and Suppliers with whom contractor has entered into subcontracts, the amount of each such subcontract, the amount requested for an Subcontractor and Supplier in the requested progress payment, and the amount to be paid to Contractor from such progress payment, together with similar sworn statements from all Subcontractors and Suppliers;

c. Duly executed waivers of mechanic's and material man's liens from all Subcontractors and, when appropriate, from Suppliers and lower tier subcontractors establishing payment or satisfaction of payment of all amounts requested by Contractor on behalf of such entities or persons in any previous Application for Payment;

d. All information and materials required to comply with the requirements of the Contract Documents or reasonably requested by Owner or Engineer;

e. Contractor's social security number (if an independent contractor) or federal employer identification number (if a corporation, partnership, or proprietorship), as appropriate;

f. Contractor must annotate the record copy of the Drawings to show all changes made each period as a condition for Engineer's recommendation of payment; and

g. Contractor must provide a certified sales tax statement with its pay application.

6. Contractor must also comply with the following specific requirements:

a. Title to all materials and equipment purchased by the Contractor for the Work shall pass to the Owner at the time Owner makes payment for such materials and equipment. The Contractor must comply with any procedures established by the Owner to secure, evidence, or establish the Owner's title to such materials and equipment.

b. With each application for payment, Contractor must submit to Owner a written list identifying each location where materials are stored off the Project site and the value of materials at each location. Contractor must procure insurance satisfactory to Owner for materials stored off the Project site in an amount not less than the total value.

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c. The consent of any surety must be obtained to the extent required prior to payment for any materials stored off the Project site.

d. Representatives of Owner and Owner's lender, if any, has the right to make inspections of the storage areas at any time.

e. Materials must be: (1) protected from diversion, destruction, theft, and damage to the satisfaction of Owner and Owner's lender, if any; (2) specifically marked for use on the Project; and (3) segregated from other materials at the storage facility.

B. *Review of Applications*

1. Engineer will, within 10 days after receipt of each complete Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, to the best of Engineer's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any payment Engineer will not be deemed to have represented:

a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or

b. Engineer is legally liable or responsible for any defects in the Work performed by the Contractor; or

c. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

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4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

a. to supervise, direct, or control the Work;

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

d. to make any examination to ascertain how or for what purposes Contractor has used the Monies paid on account of the Contract Price; or

e. to determine title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09;

d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A; or

e. there are other items warranting a set-off against the amount requested by Contractor, including, but not by way of limitation, errors or overpayments on prior payments to Contractor.

C. *Payment Becomes Due:*

1. Within thirty (30) days after receipt of a Contractor's Request for Payment with Engineer's recommendation, the Owner will:

a. Pay the Application for Payment as recommended by the Engineer.

b. Pay other amounts as Owner decides is due the Contractor, informing the Contractor and Engineer in writing stating the reasons for paying the amended amount.

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c. Withhold payment informing the Contractor and the Engineer of his reasons for withholding payment.

D. *Reduction in Payment*

1. Owner may refuse to make payment of the full amount recommended by Engineer because:

a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;

b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

c. there are other items entitling Owner to a set-off against the amount recommended;

d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A;

e. failure of the Contractor to make payments due to Subcontractors, material suppliers, or employees;

f. damage to another Contractor or any allegations of damage caused to another Contractor; or

g. Owner reasonably believes Contractor cannot complete the Work within the Contract Price.

2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount withheld. Owner will promptly pay Contractor the amount withheld, or any adjustment agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 14.02.C.1.

E. Other Payment to Contractor Provisions

1. Credit for Uncorrected Work Should the Owner direct the Contractor to leave uncorrected Work that has been damaged or was not performed in accordance with the Contract Documents, an equitable deduction from the Contract Amount will be made to compensate the Owner for the Uncorrected Work.

2. Payment for Removal of Rejected Work and Materials The removal of Work and materials rejected in accordance with paragraph 13.06.A of the Modified General Conditions and the re-execution of acceptable work by the Contractor will be at the expense of the Contractor,

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and it shall pay the cost of replacing the Work of other contractors destroyed or damaged by the removal of the rejected Work or materials and the subsequent replacement of acceptable Work.

Removal by Owner Removal of rejected Work or materials and storage of materials by the Owner, in accordance with paragraph 13.09.A of the Modified General Conditions, will be paid by the Contractor within thirty (30) days after written notice to pay is given by the Owner. If the Contractor does not pay the expenses of removal, and after ten (10) days written notice being given by the Owner of his intent to sell the materials, the Owner may sell the materials at auction or at private sale and will pay the Contractor the net proceeds after deducting all the costs and expenses that should have been borne by the Contractor.

14.03 *Contractor's Warranty of Title*

Contractor warrants and guarantees title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor must notify Owner and Engineer in writing the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request Engineer issue a certificate of Substantial Completion.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer will review the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons.

   If after the performance of such Substantial Completion Review, Engineer determines the Work is not substantially complete, Contractor shall be liable to Owner for any and all costs and expenses (including, but not limited to, Engineers fees and expenses) incurred by the Owner as a result of each failed review. Contractor covenants and agrees that Owner may retain, deduct, and/or offset monies due the Owner pursuant to this Paragraph 14.04.B.1 from Monies due to Contractor under the Agreement. Contractor further covenants and agrees Owner retains the right to make such deduction or offset at any time prior to and including final payment and that the imposition and the deduction and/or offset of such monies shall not be subject to any notice or claim provisions of the Contract Documents.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a proposed certificate of Substantial Completion which fixes the date of Substantial Completion. There must be attached to the certificate a proposed list of items to be completed or corrected before final payment. Owner has seven days after receipt of the proposed certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes the Work is not substantially complete, Engineer will, within 14 days after submission of the proposed certificate to Owner, notify Contractor in writing, stating the reasons. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised list

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of items to be completed or corrected) reflecting the changes from the proposed certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of delivery of the proposed certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and inform Engineer in writing prior to Engineer's issuing the final certificate of Substantial Completion, Engineer's recommendation will be binding on Owner and Contractor until final payment.

E. Owner has the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

14.05 *Partial Utilization*

Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work which can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. Owner, at any time, may request Contractor in writing to permit Owner to use or occupy any part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.

2. Contractor, at any time, may notify Owner and Engineer in writing that Contractor considers any part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer must make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons. If Engineer considers part of the Work to be substantially complete, the provisions of Paragraph 14.04 apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

Upon written notice from Contractor the entire Work, or an agreed portion, is fully complete, inclusive of all requirements of the Contract, Engineer will promptly make a final inspection with

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Owner and Contractor and will notify Contractor in writing of all particulars in which the inspection reveals the Work is incomplete or defective. Contractor must immediately take necessary measures to complete the Work or remedy the deficiencies.

If after the performance of the final completion inspection, Engineer determines punch list items, site or project cleanup activities remain or the Work is otherwise not fully complete in accordance with all of the requirements of the Contract Documents, Contractor shall be liable to Owner for any and all costs and expenses (including, but not limited to, Engineer's fees and expenses) incurred by the Owner as a result thereof. Contractor covenants and agrees Owner may retain, deduct, and/or offset Monies due to the Owner pursuant to this Paragraph 14.06.A.1 from Monies due to Contractor under the Agreement. Contractor further covenants and agrees Owner retains the right to make such deduction or offset at any time prior to and including final payment and the imposition and the deduction and/or offset of Monies shall not be subject to any notice or claim provisions of the Contract Documents.

14.07 *Final Payment*

A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

a. all documentation required in the Contract Documents, including, but not limited to, the evidence of insurance required by Paragraph 5.04.B.6;

b. consent of the surety, if any, to final payment;

c. a list of all Claims against Owner which Contractor believes are unsettled; and

d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

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4. Contractor must submit to the Engineer within thirty (30) days of the Final Completion date, all Maintenance and Operating Manuals, schedules, guarantees, equipment test reports, and record drawings noting all changes during construction. Failure to submit all items listed will result in Engineer's recommendation to Owner not to make final payment.

B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor must make the necessary corrections and resubmit the Application for Payment.

C. *Payment Becomes Due:*

1. Thirty days after presentation to Owner of Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and be paid by Owner to Contractor.

14.08 *Final Completion Delayed*

A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer confirms, Owner will, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for the portion of the Work fully completed and accepted must be submitted by Contractor to Engineer with the Application for payment. Payment will be made under the terms and conditions governing final payment, but it shall not constitute a waiver of Claims.

14.09 *Waiver of Claims*

The making and acceptance of final payment constitutes:

1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and

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2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

At any time and without cause, Owner may suspend the Work, or any portion thereof, for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor must resume the Work on the date fixed. Contractor will be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any suspension if Contractor makes a Claim as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events justifies termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);

2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;

3. Contractor's repeated disregard of the authority of Engineer; or

4. Contractor's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:

1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);

2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and

3. complete the Work as Owner may deem expedient, including hiring contractors on any contractual basis including payment under a cost plus contract

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute

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resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner is not required to obtain the lowest price for the Work performed.

D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 10 days of receipt of the notice.

E. Where Contractor's services have been terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor existing or which may accrue. Any retention or payment of Monies due Contractor by Owner will not release Contractor from liability.

F. If Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of the bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.

15.03 *Owner May Terminate For Convenience*

A. Owner may, at any time, terminate the contract in whole or in part for Owner's convenience and without cause. Termination by Owner under this Paragraph 15.03 will be by a notice of termination prepared by the Owner and delivered to Contractor indicating intent to terminate for convenience and the effective date.

B. Contractor will not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from termination.

C. Upon receipt of a notice of termination for convenience, Contractor shall immediately, in accordance with instruction from Owner, proceed with performance of the following duties regardless of delay in determining or adjusting amounts due under this Paragraph 15.03.C:

1. Cease operations as specified in the notice;

2. Place no further order and enter into no further subcontracts for materials, labor, services, or facilities except as necessary to complete continued portions of the Contract;

3. Terminate all subcontracts and orders to the extent they relate to the Work terminated;

4. Proceed to complete the performance of Work not terminated; and

5. Take actions that may be necessary, or Owner may direct, for the protection and preservation of the Work.

D. Upon termination, Contractor shall recover as its sole remedy payment of the percentage of the Contract Price equal to the percentage of the Work performed satisfactorily and not previously paid for as determined by the Engineer. Contractor hereby waives and forfeits all other claims

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for payment and damages, including, without limitation, anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

E. Owner shall be credited for:

1. Payments previously made to Contractor for the terminated portion of the Work;

2. Claims which Owner has against Contractor under the contract; and

3. The value of the materials, supplies, equipment, or other items that are to be disposed of by contractor that are part of the Contract Price.

15.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner does not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

Dispute Resolution for this project is governed by RULES IMPLEMENTING MEDIATED SETTLEMENT CONFERENCES IN NORTH CAROLINA PUBLIC CONSTRUCTION PROJECTS adopted February 26, 2002.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

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B. For the purposed of this contract, notices shall be given to:

Scott Burwell, P.E.

Senior Project Manager

McGill Associates, P.A.

55 Broad Street, Asheville, NC 28801

17.02 *Computation of Times*

When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

The duties and obligations imposed by these Modified General Conditions and the rights and remedies available to the parties are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph are as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, shall survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

This Contract is governed by the law of the State of North Carolina, venue in Catawba County.

17.06 *Headings*

Article and paragraph headings are inserted for convenience only and do not constitute parts of these Modified General Conditions.

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MEET NORTH CAROLINA ONE-CALL CENTER

North Carolina One-Call is a Corporation formed and funded by participating utility companies and municipalities in the interest of community and job safety and improved service through damage reduction to the utilities.

A one call toll free number, **1-800-632-4949**, provides an avenue to all of the participating members from any point within the State of North Carolina.

Anyone proposing to excavate, dig, bore, tunnel, blast or disturb the earth in any manner in which buried utilities may be damaged is requested to call the toll-free number between the hours of 7:00 a.m. and 5:00 p.m., Monday through Friday, forty-eight hours before starting the proposed work.

Within minutes of your telephone call, the participating members will be made aware of your plans and will be given pertinent information that has been provided by you about your planned work. You will be told the names of the participating members from whom you can expect a response. If there are buried facilities in the path of your activity, the route of the utilities will be staked and/or marked at no expense to you. If there are no facilities in the area of the planned work, you will be called or notified by a representative of the participating company accordingly.

Should a non-participating utility operator be serving your area, we recommend that you call them on an individual basis. All utility operators, whether company or municipality, will be provided an opportunity to become a member of North Carolina One-Call.

Naturally, knowing the route of the utilities, the excavator is expected to exercise caution and to avoid damage as the project progresses.

Damage prevention doesn't just happen - it is a planned and orderly process through which each of us can participate - **Yes, we can and will dramatically reduce damages to the utilities in the State of North Carolina! Thanks for your help.**

BEFORE YOU DIG

IN THE INTEREST OF COMMUNITY AND JOB SAFETY

AND IMPROVED SERVICE

CALL NORTH CAROLINA ONE-CALL

1-800-632-4949

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

Contractor's Application for Payment No. _____

	Application Period:	Application Date:
To (Owner): Catawba County	From (Contractor):	Via (Engineer):
Project: Blackburn Resource Recovery Facility Operator's Building	Contract: Blackburn Resource Recovery Facility Operator's Building	
Owner's Contract No.:	Contractor's Project No.:	Engineer's Project No.: 26.00701

Application For Payment

Change Order Summary

Approved Change Orders

Number	Additions	Deductions
TOTALS		
NET CHANGE BY CHANGE ORDERS		

1. ORIGINAL CONTRACT PRICE..... $ _____

2. Net change by Change Orders..... $ _____

3. Current Contract Price (Line 1 ± 2)..... $ _____

4. TOTAL COMPLETED AND STORED TO DATE
(Column F total on Progress Estimates)..... $ _____

5. RETAINAGE:

a. X _____ **Work Completed**..... $ _____

b. X _____ **Stored Material**..... $ _____

c. Total Retainage (Line 5.a + Line 5.b)..... $ _____

6. AMOUNT ELIGIBLE TO DATE (Line 4 - Line 5.c)..... $ _____

7. LESS PREVIOUS PAYMENTS (Line 6 from prior Application)..... $ _____

8. AMOUNT DUE THIS APPLICATION..... $ _____

9. BALANCE TO FINISH, PLUS RETAINAGE
(Column G total on Progress Estimates + Line 5.c above)..... $ _____

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:
(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;
(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all Liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such Liens, security interest, or encumbrances); and
(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor Signature

By:	Date:

Payment of: $ _____
(Line 8 or other - attach explanation of the other amount)

is recommended by: _____ _____
(Engineer) (Date)

Payment of: $ _____
(Line 8 or other - attach explanation of the other amount)

is approved by: _____ _____
(Owner) (Date)

Approved by: _____ _____
Funding or Financing Entity (if applicable) (Date)

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Progress Estimate - Lump Sum Work

Contractor's Application

For (Contract): Blackburn Resource Recovery Facility Operator’s Building	Application Number:
Application Period:	Application Date:

			Work Completed		E	F		G
A		B	C	D	Materials Presently Stored (not in C or D)	Total Completed and Stored to Date (C + D + E)	% (F / B)	Balance to Finish (B - F)
Specification Section No.	Description	Scheduled Value ($)	From Previous Application (C+D)	This Period				
	Totals							

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Progress Estimate - Unit Price Work **Contractor's Application**

For (Contract): Blackburn Resource Recovery Facility Operator’s Building	Application Number:
Application Period:	Application Date:

A					B	C	D	E	F		
Item		Contract Information				Estimated Quantity Installed	Value of Work Installed to Date	Materials Presently Stored (not in C)	Total Completed and Stored to Date (D + E)	% (F / B)	Balance to Finish (B - F)
Bid Item No.	Description	Item Quantity	Units	Unit Price	Total Value of Item ($)						
	Totals										

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Stored Material Summary

Contractor's Application

For (Contract): Blackburn Resource Recovery Facility Operator’s Building	Application Number:
Application Period:	Application Date:

A		B	C		D		E		F		G
					Stored Previously				Incorporated in Work		
Bid Item No.	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Storage Location	Description of Materials or Equipment Stored	Date Placed into Storage (Month/Year)	Amount ($)	Amount Stored this Month ($)	Subtotal Amount Completed and Stored to Date (D + E)	Date (Month/ Year)	Amount ($)	Materials Remaining in Storage ($) (D + E - F)
				Totals							

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SALES TAX REIMBURSEMENT STATEMENT

PROJECT **Blackburn Resource Recovery Facility Operator's Building**

CONTRACTOR _____ OWNER **Catawba County**

FOR PERIOD _____

VENDOR	ADDRESS	INVOICE	DATE	AMOUNT	N.C. TAX	COUNTY TAX	COUNTY NAME

I, _____, being duly sworn, certify that the foregoing statement of sales tax paid in connection with the referenced contract does not contain sales or use taxes paid on purchases of tangible personal property purchased by such contractors for use in performing the contract which does not annex to, affix to or in some manner become a part of the building or structure being erected, altered or repaired for the governmental entities as defined by G.S. 105-164.14(c) and is to the best of his/her belief, true and correct.

_____
Signature

Sworn to before me this ____ day of _____, 202 ____

_____
Title

My commission _____

_____
Notary Public

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ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

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Contractor's Application for Payment No.

	Application Period:	Application Date:
To (Owner): Catawba County	From (Contractor):	Via (Engineer):
Project: Blackburn Resource Recovery Facility Operator's Building	Contract: Blackburn Resource Recovery Facility Operator's Building	
Owner's Contract No.:	Contractor's Project No.:	Engineer's Project No.: 26.00701

Application For Payment

Change Order Summary

Approved Change Orders

Number	Additions	Deductions
TOTALS		
NET CHANGE BY CHANGE ORDERS		

1. ORIGINAL CONTRACT PRICE	**$**
2. Net change by Change Orders	**$**
3. Current Contract Price (Line 1 ± 2)	**$**
4. TOTAL COMPLETED AND STORED TO DATE (Column F total on Progress Estimates)	**$**
5. RETAINAGE:	
a. X _____ Work Completed	**$**
b. X _____ Stored Material	**$**
c. Total Retainage (Line 5.a + Line 5.b)	**$**
6. AMOUNT ELIGIBLE TO DATE (Line 4 - Line 5.c)	**$**
7. LESS PREVIOUS PAYMENTS (Line 6 from prior Application)	**$**
8. AMOUNT DUE THIS APPLICATION	**$**
9. BALANCE TO FINISH, PLUS RETAINAGE (Column G total on Progress Estimates + Line 5.c above)	**$**

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:
(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;
(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all Liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such Liens, security interest, or encumbrances); and
(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor Signature

By:	Date:

Payment of: $ _____
(Line 8 or other - attach explanation of the other amount)

is recommended by: _____ _____
(Engineer) (Date)

Payment of: $ _____
(Line 8 or other - attach explanation of the other amount)

is approved by: _____ _____
(Owner) (Date)

Approved by: _____ _____
Funding or Financing Entity (if applicable) (Date)

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Progress Estimate - Lump Sum Work

Contractor's Application

For (Contract): Blackburn Resource Recovery Facility Operator’s Building	Application Number:
Application Period:	Application Date:

			Work Completed		E	F		G
A		B	C	D	Materials Presently Stored (not in C or D)	Total Completed and Stored to Date (C + D + E)	% (F / B)	Balance to Finish (B - F)
Specification Section No.	Description	Scheduled Value ($)	From Previous Application (C+D)	This Period				
	Totals							

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Progress Estimate - Unit Price Work

Contractor's Application

For (Contract): Blackburn Resource Recovery Facility Operator's Building								Application Number:			
Application Period:								Application Date:			
A					B	C	D	E	F		
Item		Contract Information				Estimated Quantity Installed	Value of Work Installed to Date	Materials Presently Stored (not in C)	Total Completed and Stored to Date (D + E)	% (F / B)	Balance to Finish (B - F)
Bid Item No.	Description	Item Quantity	Units	Unit Price	Total Value of Item ($)						
	Totals										

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Stored Material Summary

Contractor's Application

For (Contract): Blackburn Resource Recovery Facility Operator's Building								Application Number:			
Application Period:								Application Date:			
A		B	C		D		E		F		G
Bid Item No.	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Storage Location	Description of Materials or Equipment Stored	Stored Previously		Amount Stored this Month ($)	Subtotal Amount Completed and Stored to Date (D + E)	Incorporated in Work		Materials Remaining in Storage ($) (D + E - F)
					Date Placed into Storage (Month/Year)	Amount ($)			Date (Month/ Year)	Amount ($)	
				Totals							

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SALES TAX REIMBURSEMENT STATEMENT

PROJECT **Blackburn Resource Recovery Facility Operator's Building**

CONTRACTOR _____

OWNER **Catawba County**

FOR PERIOD _____

VENDOR	ADDRESS	INVOICE	DATE	AMOUNT	N.C. TAX	COUNTY TAX	COUNTY NAME

I, _____, being duly sworn, certify that the foregoing statement of sales tax paid in connection with the referenced contract does not contain sales or use taxes paid on purchases of tangible personal property purchased by such contractors for use in performing the contract which does not annex to, affix to or in some manner become a part of the building or structure being erected, altered or repaired for the governmental entities as defined by G.S. 105-164.14(c) and is to the best of his/her belief, true and correct.

_____
Signature

Sworn to before me this ____ day of _____, 202 ____

_____
Title

My commission _____

_____
Notary Public

Certificate of Substantial Completion

Project: Blackburn Resource Recovery Facility Operator's Building	
Owner: Catawba County	Owner's Contract No.:
Contract: Blackburn Resource Recovery Facility Operator's Building	Engineer's Project No.: 26.00701

This [tentative] [definitive] Certificate of Substantial Completion applies to:

☐ All Work under the Contract Documents: ☐ The following specified portions of the Work:

_____

_____

_____

_____

_____
Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Project or portion thereof designated above is hereby declared and is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below.

A [tentative] [definitive] list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance and warranties shall be as provided in the Contract Documents except as amended as follows:

☐ Amended Responsibilities ☐ Not Amended

Owner's Amended Responsibilities:

_____

_____

_____

Contractor's Amended Responsibilities:

_____

_____

_____

_____

The following documents are attached to and made part of this Certificate:

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

Executed by Engineer	Date
Accepted by Contractor	Date
Accepted by Owner	Date

SECTION 013000 MEASUREMENT AND PAYMENT

01700.1 SCOPE

This section covers the method of measurement and payment for items of work under this contract.

01700.2 GENERAL

The total Bid Price for each section of the contract shall cover all work required by the Contract Documents. All costs in connection with the proper and successful completion of the work including furnishing all materials, equipment, supplies, and appurtenances; providing all construction equipment, and tools; and performing all necessary labor and supervision to fully complete the work, shall be included in the unit and Lump Sum prices bid. All work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices bid.

01700.3 ESTIMATED QUANTITIES

All estimated quantities stipulated in the Bid Form or other Contract Documents are approximate and are to be used only: a) as a basis for estimating the probable cost of the work and b) for the purpose of comparing the bids submitted for the work. The actual amounts of work done and materials furnished under unit price items may differ from the estimated quantities. In some cases a unit price item has been added to the bid schedule for the purpose of establishing a cost basis in the event work associated with that item is required. No guarantee is expressed or implied that the quantities shown in the bid schedule shall be required to fulfill the Contract. The basis of payment for work and materials will be the actual amount of work done and materials furnished. The Contractor agrees that he will make no claim for damages, anticipated profits, or otherwise on account of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts thereof.

01700.4 WORK ITEMS

The following describes the method of measurement and payment for the bid items shown in the Bid Schedule.

SECTION A – BASE BID

Item 1 - Mobilization

Work associated with Mobilization shall be paid for at the Lump Sum price as listed in the bid schedule. Partial payments for the item "Mobilization" will be made with the first and second partial pay estimates paid on the contract, and will be made at the rate of 50% of the Lump Sum price for "Mobilization" on each of these partial pay estimates. The amount for “Mobilization” in the approved schedule of values shall not exceed 5% of the total project bid. Mobilization shall include, but is not limited to, all costs for Contractor’s bonds, insurance, temporary office facilities, sanitary and power, and all other miscellaneous costs.

Item 2 – Demolition

Work associated with Demolition shall be paid for at the Lump Sum price as listed in the bid schedule. The Lump Sum price for Demolition shall include all materials, equipment, and labor required to completely clear and grub those areas requiring earthwork operations or other construction activities and the disposal of all removed material. The demolished material may be accepted at the landfill for disposal. The work shall include, but is not limited to, removal of existing asphalt paving, the removal of several trees and site features in the surrounding area, the demolition and removal of a brick screen wall, removal of vegetative material, and the removal of any other debris in those areas to receive construction activities.

Item 3 - Erosion Control

Work included in this line item of payment shall include all Erosion Control items shown on the Drawings.

The quantity of erosion control will be paid for at the contract Lump Sum price in accordance with the Contract Documents. The Lump Sum price will be the full compensation for all labor, equipment, and materials necessary for erosion control including but not limited to silt fence, silt fence outlets, and pipe/structure inlet protection as described in these specifications and/or shown on the Drawings. Repair, maintenance, and removal of these erosion control measures is included in this item.

In addition to these control measures, this item covers seeding, fertilizing, and mulching of disturbed areas. The County will retain 20% of the Lump Sum cost until a satisfactory stand of grass has been established on the disturbed areas of the site. The Lump Sum price shall include all cost for

materials, equipment, and labor for providing an acceptable stand of grass on all disturbed areas of the project in accordance with the specifications. The work shall include, but is not limited to, surface preparation, seeding, fertilizer, and mulching.

Item 4 - Earthwork

This item will be paid for on a Lump Sum basis. The Lump Sum price will be the full compensation for excavating, transporting, and stockpiling soil materials. The work includes, but is not limited to, excavation of cut material, excavation for building foundations and slab, borrow material, placement of structural fill, compacted subgrade for various paving surfaces, finish grading, diversions ditches and erosion control measures and structures. This item shall include all materials, equipment, and labor for the complete installation of earthwork.

Item 5 – Concrete Sidewalk – 4”

Work associated with this line item shall be paid for at the unit price per square yard for the Concrete Sidewalk listed in the Bid Schedule. The unit price per square yard shall include all materials, equipment, and labor for the complete installation of the concrete sidewalk as described in these Specifications and/or shown on the Drawings. The work shall include, but is not limited to, excavation, fine grading, formwork, aggregate base, concrete, steel reinforcing fabric, installation, expansion joints, curing, and maintenance during the construction period. Removal of the forms, backfilling against the slab, and fine grading to tie the slab into the surrounding site at the proposed grades shall be considered incidental to this bid item.

Item 6 - Heavy Duty Asphalt Paving

Work associated with this line item shall be paid for at the per square yard unit price for Heavy Duty Asphalt Paving as listed in the Bid Schedule. The unit price per square yard shall include all materials, equipment, and labor for the complete installation Heavy Duty Asphalt Paving as described in these Specifications and/or shown on the Drawings. The work shall include, but is not limited to, subgrade preparation, 8” Compacted Aggregate Base Course (CABC), 2.5” – Type I19.0C Asphalt Binder Course, and 1.5” – Type S9.5C Asphalt Surface Course. Application of a tack coat, as required, is considered incidental to this bid item. Grading of shoulders where applicable is considered incidental to this bid item.

Item 7 - Concrete Paving - 6”

Work associated with this line item shall be paid for at the unit price per square yard for the Concrete Paving – 6” as listed in the Bid Schedule. The unit price per square yard shall include all materials, equipment, and labor for the complete installation of the Concrete Paving – 6” as described in these Specifications and/or shown on the Drawings for the Concrete Paving Section – 6”. The work shall include, but is not limited to, excavation, fine grading, formwork, aggregate base, concrete, steel reinforcing, installation, expansion joints, curing, and maintenance during the construction period. Removal of the forms, backfilling against the slab, and fine grading to tie the slab into the surrounding site at the proposed grades shall be considered incidental to this bid item.

Item 8 - Striping & Signage

Work associated with this line item shall be paid for at the Lump Sum price as listed in the Bid Schedule. The Lump Sum price shall include all materials, equipment, and labor for the complete installation of the Pavement Markings and Signage as described in these Specifications and/or shown on the Drawings. The work shall include, but is not limited to, layout of pavement marking, furnishing paint material, placement of marking material and protection of work until such time as pavement markings have sufficiently cured for traffic, sign procurement, and sign installation.

Item 9 – Angle Wheel Stops

The work associated with installing Angle Stops shall be paid for at the unit price per linear foot installed as listed in the bid schedule. The unit price per linear foot shall include all materials, equipment and labor for the complete installation of the Angle Stops as described in the specifications and/or shown on the Drawings.

Item 10 – Tie-In to Existing Water Line

This item of work shall include the connection of the proposed water line to the existing water line as shown on the Contract Documents. The lump sum price shall include excavation and subgrade prep, cutting of the existing line, preparation and installation of miscellaneous valves and fittings, connection of the proposed water line to the existing water line, as

well as equipment and labor to perform the connection as described in the specifications and/or shown on the Drawings.

Item 11 – PVC Water Line

Work associated with this line item shall be paid for at the unit price per linear foot for the installation of the PVC Water Line as listed in the Bid Schedule. The unit price per linear foot shall include all materials, equipment, and labor for the complete installation of the water line as described in these specifications and/or shown on the Drawings. The work shall include, but is not limited to, excavation, installation of the line, temporary pavement restoration, backfill and compaction, and pressure testing and disinfection of the line.

Item 12 – Tie-in to Existing Manhole

This item of work shall include the connection of the proposed sewer line to the existing manhole as shown on the Contract Documents. The lump sum price shall include excavation and subgrade prep, cutting an entrance hole in the existing manhole, connection of the sewer pipe to the manhole, grouting of pipe opening, backfill, and any fine grading necessary to provide proper surface restoration.

Item 13 – SCH 40 PVC Sewer Line

Work associated with this line item shall be paid for at the unit price per linear foot for the Schedule 40 PVC Sanitary Sewer Collection Line as listed in the Bid Schedule. The unit price per linear foot shall include all materials, equipment, and labor for the complete installation of the PVC Sanitary Sewer Collection Line as described in these specifications and/or shown on the Drawings. The work shall include, but is not limited to, excavation, installation of the line, and backfill and compaction.

Item 14 – Sewer Cleanouts

This item of work shall include furnishing and installing sewer cleanout structures at locations shown on the Contract Documents. This item will be paid for by the actual number of structures installed at the unit price for each. The unit bid price shall include excavation, installation, and backfill and compaction around the structures as shown on the Contract Documents. The quantity of sewer cleanouts will be paid for each cleanout installed as shown on the drawings.

Item 15 – Rip Rap Outlet

This item of work shall include the furnishing and placement of rip rap (all types) w/ filter fabric underlayment, at locations directed by the Engineer and as shown on the Drawings. Rip rap for storm drainage pipe outlet protection shall be paid for under this line item.

The lump sum price shall include full compensation for excavation, furnishing, hauling, placing, shaping and compacting rip rap, including geotextile fabric underlayment. No additional payment shall be made for rip rap that must be maintained or replaced due to sedimentation.

Item 16 – Precast Concrete Endwall

This item of work shall include furnishing and installing pre-cast concrete endwalls at the locations and per standard endwall detail shown on the Contract Documents. The lump sum price shall include excavation and subgrade prep, installation of endwall, grouting of pipe opening, backfill, and any fine grading necessary to provide proper drainage for all standard concrete endwalls.

Item 17 – 12" HDPE Pipe

Measurement of HDPE storm drainage pipe shall be the actual number of linear feet of pipe installed, complete in place and accepted, measured from the starting point to the finish point of each section of line.

Storm drainage pipe shall be paid for at the unit price bid per linear foot for 12" HDPE pipe shown on the plans. The unit price bid for pipe shall include all excavation and temporary trench support if necessary, dewatering, pipe installation including tie-in to proposed structures, connection to storm drainage structures, backfill including washed stone around the pipe per detail, concrete slope anchors, backfill and compaction above pipe, testing, removal and disposal of accumulated sediment during construction.

Item 18 – 8" Trench Drain

Measurement of 8" trench drain shall be the actual number of linear feet of drain installed, complete in place and accepted, measured from the starting point to the finish point of each section of line.

The trench drain shall be paid for at the unit price bid per linear foot for 8" trench drain shown on the plans. The unit price bid for the drain shall include all excavation and temporary trench support if necessary, dewatering, drain installation including tie-in to proposed structures, connection to storm drainage structures, backfill including washed stone around the drain, concrete slope anchors, backfill and compaction around the drain, testing, and removal and disposal of accumulated sediment during construction.

Item 19 – 4" HDPE Pipe

Measurement of HDPE storm drainage pipe shall be the actual number of linear feet of pipe installed, complete in place and accepted, measured from the starting point to the finish point of each section of line.

Storm drainage pipe shall be paid for at the unit price bid per linear foot for 4" HDPE pipe shown on the plans. The unit price bid for pipe shall include all excavation and temporary trench support if necessary, dewatering, pipe installation including tie-in to proposed structures, connection to storm drainage structures, backfill including washed stone around the pipe per detail, concrete slope anchors, backfill and compaction above pipe, testing, and removal and disposal of accumulated sediment during construction.

Item 20 – Storm Structures

This item of work shall include furnishing and installing storm structures at locations shown on the Contract Documents. This item will be paid for by the actual number of structures installed at the unit price for each. The unit bid price shall include excavation, installing the structures and when applicable steps, installation of frames, grates, and hoods as shown on the

Contract Documents, backfill and compaction, and removal and disposal of accumulated sediment during construction. Storm drainage pipes shall be cut flush with the inside face of the structure walls with the gap between pipe and structure wall to be grouted smooth. The quantity of storm structures will be paid for each stormwater structure installed as shown on the drawings.

Item 21 – Operator's Building

Work associated with this line item shall be paid for at the Lump Sum price for the Operator's Building as listed in the Bid Schedule. The Lump Sum price shall include all materials, equipment, and labor for the complete installation of the Operator's Building as described in these Specifications and/or shown on the Drawings. The work shall include, but is not limited to, building foundation/floor slabs, foundation drains, framing, windows, doors, roofing, exterior siding and finish work, gutters and drains, handicap/exit signs, hardware, interior finish work, countertops, cabinetry, electrical service, electrical installation and connections, mechanical and HVAC fixture installation, plumbing and fixtures, clean outs, security lighting integral to the building, and all applicable permitting.

The Operator's Building will be paid for at the lump sum bid price for the complete building and appurtenances. The Contractor shall submit a detailed schedule of values for the building to cover all items required under this bid item. The schedule of values will be used to determine the value of the monthly invoice for payment requests. The sum of the schedule of values shall be equal to the lump sum bid amount.

Item 22 – Undercut Excavation

The quantity of undercut excavation to be paid for will be by cubic yard measured by the average end area method, based on measurements made following excavation. The quantity measured will be paid for at the Contract price for undercut unsuitable material, and disposal onsite. Work associated with this line item shall consist of the removal and disposal of residual soil deemed unsuitable during trench excavation or proofrolling prior to fill placement and placing in a location onsite as directed by the Engineer. The unit price bid per cubic yard of undercut excavation shall include all costs for excavation and hauling costs as well as all cost for the disposal onsite.

Item 23 – Washed Stone

Work associated with this line item shall consist of providing and placement of washed stone to replace material removed as part of undercut excavation and with prior approval of Engineer, substantiating the need for washed stone. Washed stone shall be from an approved source provided by the Contractor. Washed stone used for HDPE or other pipe bedding per the plans and standard details will not be paid for under this item.

Washed stone shall be paid for at the unit bid price for the total number tons used as extra pipe bedding, backfill, and/or permanent means of dewatering. Washed stone used for temporary dewatering for various components of the project, or erosion control, shall not be paid under this line item. The Contractor shall provide the Engineer haul tickets for each load of washed stone to be paid under this line item.

Item 24 - Landscaping

Work associated with Landscaping shall be paid for at a Lump Sum price. The Lump Sum price shall include all materials, equipment and labor for the complete installation of the Landscaping as required by the Catawba County Planning Department. The work shall include, but is not limited to, supplying, excavation, planting, backfilling, staking, mulching, and proper care during the construction period. Dead or diseased plantings shall be replaced as necessary throughout the one (1) year warranty period.

END OF SECTION

SECTION 024116 DEMOLITION

GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

Demolition and removal of structures and/or site improvements.

2. Abandoning in place or removing below-grade construction.
3. Disconnecting, capping or sealing, and abandoning in-place or removing site utilities.
4. Salvaging items for reuse by Owner.

B. Related Sections include the following:

Division 31 Section "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.

1.3 DEFINITIONS

Demolish: Completely remove and legally dispose of off-site.

B. Recycle: Recovery of demolition waste for subsequent processing in preparation for reuse.

C. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

D. Salvage: Carefully detach from existing construction, in a manner to prevent damage, allow for further use, and deliver to Owner. Include fasteners or brackets needed for reattachment elsewhere.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes the property of Contractor.

B. Timber, steel and other merchantable goods and materials removed incidental to demolition shall remain the property of the Owner unless otherwise directed.

C. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 SUBMITTALS

Proposed Protection Measures: Submit, as requested, informational report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

Adjacent Buildings and Property: Detail special measures proposed to protect adjacent buildings to remain and property.

Schedule of Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.
3. Shutoff and capping or re-routing of utility services.

C. Demolition Plans: Drawings indicating the following:

1. Locations of temporary protection.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Preconstruction Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by demolition operations. Comply with Division 01 Section "Photographic Documentation." Submit before the Work begins.

Landfill Records: Provide receipt for the acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was

recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI A10.6 and NFPA 241.

Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demolition including, but not limited to, the following:

Inspect and discuss condition of construction to be demolished.

2. Review and finalize demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review and finalize protection requirements.
4. Review procedures for noise control and dust control.
5. Review procedures for protection of adjacent structures.
6. Review items to be salvaged and returned to Owner.
7. Review procedures for the disposal of hazardous waste.

1.7 PROJECT CONDITIONS

Structures to be demolished will be vacated and their use discontinued before start of the Work.

B. Structures immediately adjacent to the demolition area may be occupied or otherwise in operation. Conduct demolition so operations of occupied or operating structures will not be disrupted.

1. Provide not less than three (3) business days' notice of activities that will affect operations of adjacent occupied or operating structures.
2. Maintain access to existing roadways, walkways, exits, and other facilities used by occupants/operators of adjacent structures.

    a. Do not close or obstruct roadways, walkways, exits, or other facilities used by occupants/operators of adjacent structures without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for buildings and structures to be demolished.

Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Hazardous materials will be removed by the Contractor by way of a Change Order or by the Owner under a separate contract. If the removal of hazardous materials results in a delay to the Contractor's schedule an appropriate adjustment will be made to the Contract Time by way of Change Order.

Hazardous Materials: Hazardous materials may be present in buildings and structures to be demolished. If a report on the presence of hazardous materials is on file for review and use, the Contractor may examine report to become aware of locations where hazardous materials are present.

Hazardous material remediation is specified elsewhere in the Contract Documents.

2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

Owner will provide material safety data sheets for materials that are known to be present in buildings and structures to be demolished because of building operations or processes performed there.

F. On-site storage or sale of removed items or materials is not permitted.

1.8 COORDINATION

Arrange demolition schedule so as not to interfere with Owner's on-site operations or the operations of adjacent occupied or operating structures.

PART 2 - PRODUCTS

SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Division 31 Section "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

Verify that utilities have been disconnected and capped before starting demolition operations.

Review Project Record Documents of existing construction provided by Owner, if available. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Inventory and record the condition of items to be removed and salvaged. Provide photographs and/or video of conditions that might be misconstrued as damage caused by salvage operations. Comply with Division 01 Section "Photographic Documentation."

As necessary, perform or engage a professional engineer properly licensed to practice in the state of the project site to perform an engineering survey of condition of structure to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during demolition operations.

B. Retain subparagraph below if demolition includes prestressed or post-tensioned concrete slabs.

1. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

Verify that hazardous materials have been remediated before proceeding with demolition operations.

3.2 PREPARATION

Refrigerant: Remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.

Existing Utilities: Locate, identify, disconnect, and seal or cap off all utilities serving structures to be demolished.

Arrange to shut off indicated utilities with utility companies.

2. If removal, relocation, or abandonment of utility services will affect adjacent occupied or operating structures, then provide temporary utilities that bypass structures to be demolished and that maintain continuity of service to other structures.

3. Cut off pipe or conduit a minimum of 36 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.

C. Existing Utilities: Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

D. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

E. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner or indicated on Drawings.
5. Protect items from damage during transport and storage.

3.3 PROTECTION

A. Existing Facilities: Protect adjacent roadways, walkways, loading docks, structure entries, and other facilities during demolition operations. Maintain exits from existing structures.

B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.

Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.

2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.

a. Provide at least 3 business days' notice to occupants/operators of affected structures if shutdown of service is required during changeover.

Temporary Protection: Erect temporary protection, such as roadways, walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Division 01 Section "Temporary Facilities and Controls."

1. Protect adjacent structures and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent structures and facilities to remain.
5. Provide protection to ensure safe passage of people around demolition area and to and from occupied or operating portions of adjacent structures.
6. Protect all adjacent improvements that are to remain and that are exposed to demolition operations.
7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied or operating portions of adjacent structures.

D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.4 DEMOLITION, GENERAL

A. General: Demolish indicated existing structures and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least two hours after flame cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate demolition equipment and remove debris and materials so as not to impose excessive loads on any part of the structure.

During demolition, perform surveys to detect hazards that may result from demolition activities.

C. Site Access and Temporary Controls: Conduct demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and operating facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or operating facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed areas if required by Owner or authorities having jurisdiction.

Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental protection regulations. Do not use water when it may damage

adjacent structures or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

D. Bituminous Paved Areas: Scarify and completely remove. Resultant material may be utilized in bottom portion of areas to receive fill. No pieces shall be left exposed in the fill slopes. If material is used in any portion of the new construction, layers shall be a maximum of 8 inches and separated by minimum 6-inch layers of earth. Water and compaction requirements are specified under other sections. No compaction is required for materials used for obliteration work outside the limits of new construction.

E. Removal of Concrete Surfaces and Structures: Concrete designated for removal, break into pieces and use for rip rap. Volume, minimum 0.5 cubic feet; 75 percent of pieces shall be between 1.5 and 2.0 cubic feet. Stockpile at designated locations.

F. Pipe Removal: Remove pipe, exercising care to avoid breaking or damaging. Store pipe to be relaid as directed.

3.5 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural members systematically, from higher to lower level.

B. Remove debris from elevated portions of a structure by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Salvage: Items to be salvaged are indicated on Drawings.

D. Below-Grade Construction: Demolish all below-grade construction that is within the footprint of new construction and extending 5 feet outside footprint indicated for new construction. Abandon below-grade construction outside this area.

1. Remove below-grade construction to at least 36 inches below grade, unless otherwise indicated.

E. Existing Utilities: Abandon existing utilities and below-grade utility structures as shown on the Drawings.

1. Fill abandoned utility structures with satisfactory materials according to backfill requirements in Division 31 Section "Earth Moving."
2. Piping: Disconnect piping at unions, flanges, valves, or fittings.
3. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

3.6 DEMOLITION BY EXPLOSIVES

Legal Requirements: Obtain written permission from authorities having jurisdiction before bringing explosives to, or using explosives on, Project site. Comply with all applicable Federal, State, and local laws and regulations pertaining to the use, storage, and handling of explosives. It is the intent of these specifications to require compliance with all current, pertinent laws and regulations. In the event of inconsistencies between these specifications and these laws and regulations, the laws and regulations shall take precedence, subject to final determination by the Engineer.

B. Protection: The Contractor shall exercise the utmost care not to endanger life and property. Make proper use of blasting mats and other protective devices adopting whatever additional precautions are necessary to prevent damage to adjacent structures, property, or site improvements when using explosives. Make every effort to prevent damage to the natural and the constructed surroundings. Should damage occur, make restoration as required by the Engineer.

C. Personnel: One competent, experienced person shall be specifically designated in charge of explosives. The designated person must present certification to the Engineer that they has successfully completed a course in the handling and use of explosives, given by an accredited institution such as the U.S. Bureau of Mines, DuPont, or other explosive manufacturing company. They shall exercise careful supervision of all work related to the use, storage, and handling of explosives. Permit only a minimum number of competent, experienced persons, consistent with efficient operation, to handle explosives. Exclude any one demonstrating carelessness, incompetence, or inexperience from further handling of explosives.

D. General Requirements: The Contractor shall give special attention to the following specific rules:

1. Locate magazines in accordance with the American Table of Distances for Storage of Explosives and only at sites approved by the Engineer.
2. Magazines shall be bulletproof, fireproof, burglarproof, weather resistant, constructed with adequate screened ventilation and dry wood floors. Countersink all nails exposed to the interior of magazines.
3. Do not store detonators with other explosives but in separate magazines.
4. Magazines shall not be provided with artificial heat or lights.
5. Securely lock magazines.
6. Mark magazines and roads in area with appropriate caution and danger signs.
7. Clear blast area of unnecessary personnel and equipment before delivery of any explosives to the site.
8. Keep no more than a one day supply of explosives at or near the work site. Keep explosives in approved portable magazines in locations approved by the Engineer.
9. Use only wooden tamping bars for charging explosives into drill holes.

10. Do not use electricity from light or power circuits for firing shots unless the electrical connection to the circuit is made within an enclosed switch box securely locked with switch in open position.
11. Provide a positive warning system to give adequate warning in every direction immediately prior to firing explosives. Guard all access points to the blast area to halt personnel and vehicles a safe distance from the blast. Maintain intercommunication between guards and person firing the blast assuring the blast area is clear prior to firing.
12. Provide special signs or signals at all access points including a warning to turn off radio transmitters whenever electrical detonators are used.

3.7 SITE RESTORATION

A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from demolition operations with satisfactory soil materials according to backfill requirements in Division 31 Section "Earth Moving."

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades. Eliminate areas where water may collect in depressions.

3.8 REPAIRS

A. Promptly repair damage to adjacent improvements caused by demolition operations.

3.9 DISPOSAL OF DEMOLISHED MATERIALS

General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an approved landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

3.10 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing before demolition operations began.

END OF SECTION 024116

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Related Documents:

1. Drawings and general provisions of the Subcontract apply to this Section.
2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

B. Section Includes:

1. Cast-in-place concrete.

1.02 REFERENCE STANDARDS

A. American Concrete Institute (ACI):

1. ACI 211.1 - Proportioning Concrete Mixtures
2. ACI 301- Specifications for Structural Concrete
3. ACI 303.1 - Specification for Cast-in-Place Architectural Concrete
4. ACI 305 - Hot Weather Concreting
5. ACI 306 - Specifications for Cold Weather Concreting
6. ACI 308 - Specifications for Curing Concrete
7. ACI 309 - Consolidation of Concrete
8. ACI 318 - Building Code Requirements for Structural Concrete

B. American Society for Testing and Material (ASTM)

1. ASTM C31 - Practice for Making and Curing Concrete Test Specimens in the Field
2. ASTM C33 - Specification for Concrete Aggregates
3. ASTM C94 - Specification for Ready Mix Concrete
4. ASTM C143 - Test Method for Slump of Hydraulic Concrete
5. ASTM C150 - Specification for Portland Cement
6. ASTM C156 - Standard Test Method for Water Retention by Liquid Membrane Forming Curing Compounds for Concrete
7. ASTM C171 - Specification for Sheet Materials for Curing Concrete
8. ASTM C172 - Practice for Sampling Freshly Mixed Concrete
9. ASTM C260 - Specifications for Air Entraining Admixtures for Concrete
10. ASTM C309 - Specification for Liquid Membrane - Forming Compounds for Curing Concrete
11. ASTM C330 - Specification for Lightweight Aggregates for Structural Concrete
12. ASTM C494 - Specification for Chemical Admixtures for Concrete
13. ASTM C567 - Test Method for Determining Density of Structural Lightweight Concrete
14. ASTM C618 - Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
15. ASTM C881 - Specification for Epoxy - Resin - Base Bonding Systems for Concrete
16. ASTM E1745 - Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs

C. American Association of State Highway and Transportation Officials (AASHTO):

1. M182-60 - Burlap Cloth Made for Jute or Kelat

D. American Institute of Steel Construction (AISC):

1. Code of Standard Practice for Steel Buildings and Bridges

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data form proprietary materials, including admixtures curing materials, and finish materials.

C. Submit Placement Shop Drawings, showing location of construction joints. Clearly indicate the construction joints in different locations that those shown in the Drawings.

D. Samples: As requested by Testing Laboratory.

E. Submit certification that the facilities of the ready-mix plant comply with the requirements of ASTM C94.

F. Material Certificates:

1. Cementitious materials, including supplemental cementitous material.
2. Aggregates, including gradation and combined gradation.
3. Admixtures. Where more than one admixture is proposed, include statement from admixture manufacturer indicating that admixtures proposed for use are compatible, such that desirable effects of each admixture will be realized.

G. Submit ticket to Testing Laboratory for each batch of concrete delivered, bearing the following information. Refer to "Field Quality Control" Article of this Section.

1. Mix identification.
2. Weights of cementitious materials, aggregates, water and admixtures, and aggregate size.

1.04 QUALITY ASSURANCE

A. Quality assurance and inspection shall be in accordance with Division 01 Section "Special Provisions".

B. Standards: Comply with provisions of ACI 301, except where more stringent requirements are indicated. Evaluation and acceptance of concrete structures will be in accordance with ACI 301.

C. Certificates of Compliance: Acceptability of the following materials will be based upon documentation furnished by the manufacturer identifying each batch of material and certifying compliance with the requirements specified:

1. Portland cement.
2. Fly ash.
3. Chemical admixtures.

D. Survey anchor bolts for placement and alignment prior to casting concrete.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Cementitious materials and aggregates for exposed concrete shall be from same source throughout the work.

B. Cementitious Material: An intimate blend of Portland cement and supplemental cementitious material. Cementitious material shall include 15 percent minimum to a maximum of 25 percent, 50% percent minimum to a maximum of 60 percent fly ash or ground blast furnace slag by weight unless the strength is specified to be achieved in 7 or 14 days. Cementitious material shall comply with ACI 318 Chapter 4 requirements for exposure class S1.

C. Supplemental Cementitious Materials:

1. Fly Ash: ASTM C618, Class F with the following Modified ASTM requirements:
    a. Loss of Ignition (L.O.I.): maximum 1 percent.
    b. Sulfur Trioxide (SO_3) shall not exceed 3 percent by weight.
    c. Water requirement maximum: 100 percent control.
        i. R=(CaO-5 percent)/(Fe_2O_3), where R (sulfate resistance) is 0.75 maximum and CaO/Fe2O3 is the percentage from fly ash oxide analysis.

2. Ground Blast Furnace Slag: ASTM C989.

D. Aggregate for Standard Weight Concrete: ASTM C33, except as modified herein:
   1. Coarse Aggregates: Cleanness Value of not less than 75.
   2. Coarse Aggregate for Shrinkage Controlled Concrete.
   3. Fine Aggregates: Sand Equivalent of not less than 75.

E. Aggregate for Lightweight Concrete: ASTM C330. Lightweight aggregate shall be vacuum saturated expanded shale or clay produced by rotary kiln

F. Water: Mixing water shall be clean, potable and free from deleterious material.

G. Admixtures:
   1. Admixtures containing more than 0.05 percent chloride ions are not permitted.
   2. Where mix contains more than one admixture, all admixtures shall be supplied by one manufacturer. Manufacturer shall certify that admixtures are compatible such that desirable effects of each admixture will be realized.
   3. Liquid admixtures shall be considered part of the total water.

H. Lightweight Concrete shall contain an air entrainment admixture conforming to ASTM C260, to produce an air content of 3 to 5 percent at point of placement.

I. Water Reducing Admixture: ASTM C494, Type A. Provide in all concrete at necessary dosage to facilitate placement.

J. Mid to High Range Water Reducing Admixture: ASTM C494, Type F; polycarboxylate formulation. Provide in mid-range or high-range dosage as necessary for placement at the maximum water to cement ratio specified.

K. Set Accelerating Admixture: ASTM C494, Type E, non-chloride.

L. Set Retarding Admixture: ASTM C494, Type D.

M. Color Admixtures: ASTM C579.

2.02 ACCESSORIES

A. Curing Compounds: ASTM C309, Type I, clear or translucent without dye, Type 1-D, clear or translucent with fugitive dye or Type 2, white pigmented and which will not discolor concrete or affect bonding of other finishes applied thereover, and which restricts loss of water to not more than 0.500 grams per square centimeter of surface when tested per ASTM C156, “Test Method for Water Retention by Concrete Curing Materials.”

B. Slab Curing Membrane: Membrane conforming to ASTM C171, non-staining.

C. Burlap Sheet: AASHTO M182, class 3 or 4.

D. Surface Hardener: Lapidolith, Hornolith, Kemi-Kal Liquid or equal.

E. Rock Base: Clean, hard and durable gravel or crushed rock conforming to the requirements of CalTrans Standard Specifications Section 68 for Class 1, Type A permeable material.

F. Vapor Barrier: ASTM D2103, “Polyethylene Film and Sheeting.”

G. Sand Cover: Uniformly graded, clean sand free from excessive fines, organic materials or other deleterious substances.

H. Form Tie Cone Hole Plugs: Burke Co., Grey, Recessed, Jumbo Cone, “Snaplug”, or equal (no known equal) with waterproof adhesive.

I. Filter drains such as behind concrete walls: Type A drain rock conforming to Division 31 Section "Backfilling" or prefabricated drain manufactured with polyethylene stranded or molded core and a geotextile fabric bonded to one side. Filter drains shall be manufactured by Mirafi, Exxon or equal approved by the Architect/Engineer.

J. Embedded Reglets and Dovetail Anchor Slots: 18 gauge galvanized steel.

K. Bonding Agent: Burke Acrylic Bondcrete, Thorobond or equal.

2.03 CONCRETE MIXES

A. Schedule of Concrete Classes:

Mix ID/Use		Aggregate Size	Slump	Min. Strength	Other Req'ts
Mix A	Drilled Piers, Foundations	Size 57 (1 inch) (25 mm)	4 to 6 inches (100 to 150 mm)	4000 psi (27.6 MPa)	
Mix B	Walls, Columns, Suspended Slabs & Beams	Size 57 (1 inch) (25 mm)	4 to 6 inches (100 to 150 mm)	4000 psi (27.6 MPa)	Req't E.1, Req't E.2
Mix C	Floor Slabs on Grade, Miscellaneous Concrete	Size 57 (1 inch) (25 mm)	3 to 5 inches (75 to 125 mm)	4000 psi (27.6 MPa)	Req't E.1, Req't E.2
Mix D	Exterior Concrete Slab	1 inch (25 mm) by	3 to 5 inches (75 to 125 mm)	4000 psi (27.6 MPa)	Req'ts E.2 and E.3
Mix E	Miscellaneous concrete for curbs, pads, etc.	Size 57 (1 inch) (25 mm)	3 to 5 inches (75 to 125 mm)	3500 psi (24.1 MPa)	
Lean Concrete		Size 57 (1 inch) (25 mm)	3 to 5 inches (75 to 125 mm)	1500 psi (10.3 MPa)	

B. Aggregate: Coarse aggregate size number in accordance with ASTM C33 for normal-weight aggregate. Coarse aggregate size in accordance with ASTM C330 for lightweight aggregates.

C. Slump: Minimum-maximum slump at point of placement in inches when tested in accordance with ASTM C143.

D. Strength: Minimum compressive strength in psi after [7] [14] [28] days, tested in accordance with ASTM C39.

E. Other Requirements (apply only where indicated in Schedule of Concrete Mixes)

1. Shrinkage Controlled Concrete: Use special coarse aggregates specified. Select materials and proportion mix to achieve shrinkage less than 0.040 percent (ASTM C157 modified).
2. Water to Cementitious Material Ratio: Mixes "B","C" and "D" shall have a water-to-cementitious-material ratio not exceeding 0.45 by weight. Weight of water shall include all free moisture, including liquid admixtures. Mixes shall contain specified high range water reducing admixture at mid-range dosage as required to achieve specified slump.
3. Lightweight Concrete: Equilibrium weight (at 100 days air dry) of 113 pcf plus or minus 3 pcf, ASTM C567. Mix shall contain 4 percent, plus or minus 1 percent, entrained air by volume at point of placement.

F. Proposed mixes shall produce concrete to strengths specified with adequate workability and proper consistency to permit concrete to be worked into forms and around reinforcement without excessive segregation or bleeding.

G. Add air entraining agent to normal weight concrete mix for work exposed to exterior.

H. Concrete mixes used for liquid nitrogen tank foundations shall comply with ACI 318 Chapter 4 requirements for exposure class F1.

I. For any concrete mix that uses greater than 45% total cementitious material the maximum water-cement ratio shall not exceed 0.38.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify site conditions under provisions of Division 01 Section "General Provisions".

B. Verify requirements for concrete cover over reinforcement.

C. Verify that anchor bolts, embedded plates, reinforcement, sleeves and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.02 FORMWORK ERECTION

A. Verify lines, levels, and measurement before proceeding with formwork.

B. Hand trim sides and bottom of earth forms; remove loose dirt.

C. Align form joints.

D. Do not apply form release agent to concrete surfaces which receive special finishes or applied coatings that may be affected by agent.

1. Coordinate work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

3.03 REINFORCEMENT & EMBEDDED ITEMS

A. Place, support, and secure reinforcement and embedded items against displacement.

B. Installation tolerances for anchor bolts for structural steel columns shall comply with the AISC Code of Standard Practice for Steel Buildings and Bridges requirements for tolerances.

C. Only items that are dimensionally located on the drawings may be embedded in concrete regardless of the trade responsible for placing them.

3.04 PLACING CONCRETE

A. Notify the Owner at least 48 hours prior to commencement of concreting operations. No concrete shall be placed until all subgrade, formwork, reinforcing steel, embedded items and surfaces against which concrete is to be placed have been accepted by the Owner. The rate of delivery, haul time, missing time and hopper capacity shall be such that all mixed concrete delivered shall be placed in forms within 90 minutes from the time of the introduction of cement and water into the mixer. No water shall be added after transit mixer leaves the batching plant without the approval of the Owner.

B. Prepare previously placed concrete by cleaning with steel brush or sandblasting and applying bonding agent in accordance with manufacturer's instruction.

C. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout or epoxy grout.

D. Foundation surfaces against which concrete is to be placed must be free from standing water, mud and debris. Surfaces shall be clean and free from oil, objectionable coatings, and loose or unsound material.

E. All surfaces of forms and embedded items shall be free of grout before placing concrete.

F. Install joint fillers and waterstops in accordance with manufacturer's instructions. Install 1/2-inch thick joint filler to separate slabs on grade from vertical surfaces. Extend joint filler from bottom of slab to within ¼-inch of finished slab surface.

G. Locate construction joints where indicated on the Structural Drawings

H. When ambient temperature is expected to exceed 80 degrees F during placing or finishing operations, steps shall be taken in accordance with ACI 305, "Recommended Practices for Hot Weather Concreting", to reduce concrete temperature and water evaporation by proper attention to the ingredients, production methods, handling, placing, protection and curing. The Subcontractor shall submit a detailed hot weather concreting procedure to the A/E for approval at least two business days before concrete placement is planned. The Subcontractor's testing agency will produce trial batches in accordance with ACI 305. Slabs will be fog sprayed from the completion of skreeding until curing is begun; the fog spray may be discontinued on sections during troweling.

3.05 FLOOR SLABS

A. Place floor slabs as indicated on Drawings. Saw cut control joints at an optimum time after finishing. Cut slabs with a 3/16-inch thick blade to 1 inch depth.

B. Separate slabs on grade from vertical surfaces with joint filler. Extend joint filler from bottom of slab to within ¼ inch of finished slab surface.

C. Install joint devices and joint device anchors in accordance with manufacturer's instructions. Maintain correct position to allow joint cover flush with floor finish.

D. Construct slab on grade and shored elevated floor slabs with overall specified F_F30/F_L20 and with minimum F_F15/F_L10 for individual floor sections in accordance with ACI 302.1. Determination of F_F/F_L numbers will be in accordance with ASTM E 1155. The Subcontractor will take remedial measures when floor slabs do not meet specified requirements The Subcontractor's plan for remedial measures shall be submitted to the Owner for review and approval. Slope slabs to drains 1/4 inch per foot nominal.

3.06 CURING & PROTECTION

A. Wheeling, working and walking on concrete shall be avoided for at least 24 hours after casting. Protect concrete from sun and rain. Do not permit concrete to become dry during curing period. Concrete shall not be subjected to any loads until concrete is completely cured, and until concrete has attained its 28 day strength.

B. Protect concrete during and after curing from damage during subsequent building construction operations.

C. Cover traffic areas with plywood or other suitable means for as long as necessary to protect concrete from damage.

D. Specific curing requirements for slabs shall include the following: Immediately upon completion of finishing operation, the surface of slabs shall be sealed against moisture loss by the application of a curing blanket made of polyetheylene bonded to burlap in accordance with the manufacturer's instructions. Alternatively, waterproof curing paper may be used with edges lapped and sealed with tape. The curing membrane shall be weighted down. Tears and rips in curing membrane shall be repaired immediately during curing period. Curing shall be maintained for [7] [14] [21] days.

E. Specific curing requirements for walls, beams and columns shall include the following: Concrete in forms shall be kept moist until removal. Immediately upon removal of forms, an approved sprayed-on curing compound shall be applied to the concrete surfaces in strict compliance with the manufacturer's recommendations. Curing shall be maintained for [7] [14] days.

F. For above grade concrete sections over three feet thick in all three orthogonal directions except lean concrete:

1. Ten days before placing concrete, the results of thermal test performed by the Subcontractor will be submitted to the Owner for approval. Thermal tests shall consist of a three foot test cube of the design mix for the thick section instrumented with thermocouples by the Subcontractor's testing agency and monitored to determine whether the heat of hydration exceeds 150 deg F (66 deg C). If the temperature exceeds 150 deg F (66 deg C) , the mix design will be revised or standard aggregate cooling utilized and a second test cube cast and tested at no additional cost to the Owner.

2. The temperature gradient between the center and the surface of the section must not exceed 20 deg F (6.6 deg C) during the first ten days of the controlled curing period. Thermocouples shall be installed by the Subcontractor's testing agency in the center and six inches from the surface at twenty foot intervals and at the corners. The thermocouples are to be monitored continuously by the Subcontractor's testing agency and, if the temperature gradient exceeds 20 deg (6.6 deg C), insulating blankets shall be

placed over the surface. On surfaces with protruding reinforcing, such as the top of a wall, loose insulation will be used.

3.07 FIELD QUALITY CONTROL

A. Inspection and Testing will be performed under provisions of Division 01.

B. Testing Laboratory will:

1. Collect and review tickets for each batch of concrete delivered. Annotate water or admixtures added subsequent to batching.
2. Special Inspect concrete placement, as required by CBC Section 1701.5, Item 1, for conformance with the Contract Documents.
3. Slump: ASTM C143; one test at point of placement at start of each day's pour; additional tests when concrete consistency appears to have changed.
4. Compressive Strength: Test concrete for compressive strength in accordance with CBC Section 1905.6 and ASTM C39. Conform to testing frequency of CBC 1905.6.1. Take 4 specimens per sample, test one at seven days, two at 28 days, and retain one specimen.
5. Temperature: ASTM C1064; one test hourly. Take additional tests where warranted by weather conditions or delays in delivery.
6. Air Content: ASTM C173; for mixes with more than 3 percent air, take one test hourly at point of placement.
7. The Subcontractor will be responsible for all Testing Laboratory costs for investigating low-strength compressive test results in accordance with CBC Section 1905.6.5.

END OF SECTION

SECTION 04 22 00

CONCRETE MASONRY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete unit masonry.

1.02 REFERENCES

A. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

B. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

C. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

D. ASTM C 150 - Standard Specification for Portland Cement.

1.03 SUBMITTALS

A. Product Data: Manufacturer's product data for each type of masonry unit, accessory, and other manufactured products.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Oldcastle APG or equal. Cinder type block are not acceptable.

2.02 CONCRETE MASONRY UNITS

A. Provide special shapes where required for lintels, jambs, corners, sash, control joints, headers, bonding, and other special conditions.

2.03 MORTAR AND GROUT

A. Materials:

1. Portland Cement: ASTM C 150, Type I, except Type III for construction below 40 degrees F. Mortar shall have a minimum compression strength (f'm) of 1,500 psi at 28 days.

    a. All CMU cells containing reinforcement or otherwise indicated to be grouted shall be filled with grout. Grout is to conform to ASTM C-476 “Grout for Masonry”. The grout shall have a minimum 28-day compressive strength of 2000 psi

    b. Color: Natural.

2.04 JOINT REINFORCEMENT, TIES, AND ANCHORS

A. General: Comply with requirements indicated below for basic materials, as well as requirements for each form of joint reinforcement, tie, and anchor for size and other characteristics.

B. Hot-Dip Galvanized Steel Wire: Uncoated wire per ASTM A 82, with zinc coating applied after prefabrication into units per ASTM A 123/A 123M, 1.5 oz. per sq. ft. of wire surface.

C. Joint Reinforcement: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units.

D. Reinforcing Bars: Deformed steel, ASTM A 615, Grade 60 for bars No. 3 to No. 18. reinforcing bars shall be continuous

PART 3 EXECUTION

3.01 PREPARATION

A. Protect base of walls from rain-splashed mud and/or mortar splatter by means of coverings spread on ground and over wall surfaces.

B. Protect sills, ledges, and projections from mortar droppings.

3.02 INSTALLATION

A. Mortar: When ambient temperatures drop below 40 degrees F, heat mortar materials while

masonry work is progressing, maintain mixing temperature selected within 10 degrees F. Comply with the following procedures based upon the following ambient air temperature ranges at the time of installation.

1. 40 Degrees to 32 Degrees F:
    a. Heat mixing water to produce mortar temperature between 40 degrees and 120 degrees F.
2. 32 Degrees to 25 Degrees F:
    a. Heat mixing water and sand to produce mortar temperature between 40 degrees and 120 degrees F.
    b. Maintain temperature of mortar on boards above freezing.
3. 25 Degrees to 20 Degrees F:
    a. Heat mixing water and sand to produce mortar temperature between 40 degrees and 120 degrees F.
    b. Maintain temperature of mortar on boards above freezing.
    c. Heat both sides of walls under construction using salamanders or other heat sources.
    d. Use windbreaks or enclosures when wind exceeds 15 mph.
4. 20 Degrees F and Below:
    a. Heat mixing water and sand to produce mortar temperature between 40 degrees and 120 degrees F; do not heat mixing water to above 160 degrees F.
    b. Heat masonry units to above 20 degrees F at time of laying.
    c. Provide enclosure and auxiliary heat to maintain an air temperature of at least 40 degrees F for 24 hours after laying units.

B. Grout: When night temperatures are expected to drop below 40 degrees F, heat grout materials while masonry work is progressing, maintaining mixing temperature selected within 10 degrees F. Comply with the following procedures based upon the following anticipated minimum night temperature ranges.

1. 40 Degrees to 32 Degrees F:
    a. Heat mixing water to produce grout temperature between 40 degrees and 120 degrees F.
2. 32 Degrees to 25 Degrees F:
    a. Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at end of work day.
3. 25 Degrees to 20 Degrees F:
    a. Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at end of work day.
    b. Heat both sides of walls under construction using salamanders or other heat sources.
    c. Use windbreaks or enclosures when wind exceeds 15 mph.
4. 20 Degrees F and Below:
    a. Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at end of work day; do not heat mixing water to above 160 degrees F.
    b. Heat masonry units to above 20 degrees F at time of laying.
    c. Provide enclosure and auxiliary heat to maintain an air temperature of at least 40 degrees F for 24 hours after laying units.

END OF SECTION

SECTION 05 40 00
COLD FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Load bearing formed steel stud exterior wall framing.

1.02 RELATED SECTIONS

A. Section 04 81 60 - Masonry Veneer: Veneer masonry supported by wall stud metal framing.

1.03 REFERENCES

A. AISI SG-971 - Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 1996, with 2000 supplement.

B. AISI SG-973 - Cold-Formed Steel Design Manual; American Iron and Steel Institute; 1996.

C. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 1997a.

D. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2001a.

E. ASTM C 955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2001.

F. AWS D1.1 - Structural Welding Code - Steel; American Welding Society; 2002.

G. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 1982 (Ed. 2000).

1.04 SYSTEM DESCRIPTION

A. Install wall components to accommodate a vertical deflection of the roof structure of not less than ¾ in vertical deflection. This can be done with a double-slip track connection or other method approved by the Architect and Structural Engineer.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate component details, framed openings, and accessories or items required of related work.

1. Indicate stud and ceiling joist layout.

C. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.

1.06 MOCK-UP

A. Provide mock-up of exterior framed wall, including components specified elsewhere, such as insulation, sheathing, window frame, door frame, exterior wall finish, and interior wall finish.

B. Mock-Up Size: 10x10 feet, including corner condition.

C. Location: As directed.

D. Mock-up may remain as part of the Work.

1.08 PROJECT CONDITIONS

A. Verify that field measurements are as indicated on the drawings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing:

1. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FRAMING MATERIALS

A. Studs and Track: ASTM C 955; studs formed to channel shape with punched web; U-shaped track in matching nominal width and compatible height.

1. Gage and depth: As indicated on the drawings.
2. Galvanized in accordance with ASTM A 653/A 653M G90/Z275 coating.

2.03 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Plates, Gussets, Clips: Formed Sheet Steel, thickness determined for conditions encountered; finish to match framing components.

C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.04 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A 153/A 153M.

B. Anchorage Devices: Powder-actuated as indicated on drawings.

C. Welding: In conformance with AWS D1.1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions.

B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 16 inches on center, unless otherwise noted on drawings. Coordinate installation of sealant with floor and ceiling tracks.

C. Place studs at 16 inches on center, or as indicated on drawings; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using clip and tie method.

D. Construct corners using minimum of three studs. Install double jamb with double studs full height of wall (4 members) at wall openings, door and window jambs.

E. Install load bearing studs full length in one piece. Splicing of studs is not permitted.

F. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.

G. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

H. Install intermediate studs above and below openings to align with wall stud spacing.

I. Attach cross studs to studs for attachment of fixtures anchored to walls.

J. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

K. Touch-up field welds and damaged galvanized surfaces with primer.

END OF SECTION

SECTION 054400
COLD-FORMED METAL TRUSSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Light gauge cold-formed steel roof trusses.

B. Anchorages, bracing, and bridging.

1.02 RELATED REQUIREMENTS

A. Section 054000 - Cold-Formed Metal Framing: Light gauge structural metal studs, joists, and rafters.

B. Section 061000 - Rough Carpentry: Floor and roof sheathing.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2024.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

C. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

E. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2025, with Errata (2026).

F. CFSEI 5000 - Field Installation Guide for Cold-Formed Steel Roof Trusses; May 2000.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Meet at project site prior to beginning of installation to review requirements. Require attendance by representatives of the following:
   1. Truss fabricator.
   2. Truss installer.
   3. Other entities affected by the work of this section, including but not limited to truss support framing installer, mechanical systems installer, and electrical systems installer.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Span charts.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings:
   1. Include detailed roof truss layout.
   2. Show member type, location, spacing, size and gauge, methods of attachment, and erection details. Indicate supplemental bracing, strapping, splices, bridging, and accessories.
   3. Include truss design drawings, signed and sealed by a qualified professional engineer registered in the State in which the Project is located, verifying ability of each truss design to meet applicable code and design requirements.
      a. Include the following:
         1) Design criteria.
         2) Engineering analysis depicting member stresses and deflections.
         3) Member sizes and gauges.
         4) Details of connections at truss joints.
         5) Truss support reactions.

6) Bracing requirements.

D. Steel Framing Industry Association (SFIA) Certification:
   1. Submit documentation that metal studs and connectors used on project meet or exceed requirements of International Building Code.
   2. Submit current documentation of contractor accreditation and installer certification. Keep copies of each on-site during and after installation, and present upon request.

E. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

F. Designer's Qualification Statement.

G. Fabricator's Qualification Statement.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design trusses under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. SFIA Code Compliance Certification Program: www.CFSteel.org/#sle: Use metal studs and connectors certified for compliance with International Building Code.

C. Professional Contractor and Truss Fabricator Qualifications: SFIA-accredited contractor and fabricator: www.CFSteel.org/#sle.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver trusses and other materials in manufacturer’s unopened bundles or containers, each marked with manufacturer’s name, brand, type, and grade. Exercise care to avoid damage during unloading, storing, and erection.

B. Store trusses on blocking, pallets, platforms, or other supports, off the ground and in an upright position, sufficiently braced to avoid damage from excessive bending. Gently slope stored trusses to avoid accumulation of water on interior of truss chord members.

C. Protect trusses and accessories from contact with earth, corrosion, deformation, mechanical damage, or other deterioration when stored at project site.

PART 2 PRODUCTS

2.01 TRUSS DESIGN REQUIREMENTS

A. Design: Calculate structural characteristics of cold-formed steel truss members according to AISI S100.

B. Structural Performance: Design, engineer, fabricate, and erect trusses to withstand specified design loads for project conditions within required limits.
   1. Design Loads: In accordance with applicable codes.
   2. Deflections: Live load deflection meeting the following, unless otherwise indicated:
      a. Roofs: Maximum vertical deflection under live load of 1/240 of span.
   3. Design trusses to accommodate movement attributable to temperature changes within a range of 120 degrees F (67 degrees C) without damage or overstressing, sheathing failure, undue strain on fasteners and anchors, or other deleterious effects.

2.02 COMPONENTS

A. Trusses: Light gauge steel assemblies providing a complete horizontal framing system for locations indicated, ready for deck installation.
   1. Truss Type, Span, and Height: As indicated on drawings.
   2. Chord and Web Members: Fabricate required shapes from commercial quality galvanized steel sheet complying with ASTM A653/A653M, with minimum yield strength of 40,000 psi (275 MPa); minimum G60/Z180 coating; gauges as required for load conditions; all edges rolled or closed.

B. Fasteners: Self-drilling, self-tapping screw fasteners with corrosion-resistant plated finish, as recommended by steel truss manufacturer and marked for easy identification.
   1. Welding: Comply with applicable provisions of AWS D1.1/D1.1M and AWS D1.3/D1.3M.

C. Bracing, Bridging, and Blocking Members: Fabricate required shapes from commercial quality galvanized steel sheet complying with ASTM A653/A653M, with minimum yield strength of 33,000 psi (230 MPa); minimum G60/Z180 coating; gauges as required for load conditions.

2.03 FABRICATION

A. Factory fabricate cold-formed steel trusses plumb, square, true to line, and with secure connections, complying with manufacturer's recommendations and project requirements.
   1. Fabricate trusses using jig templates.
   2. Cut truss members by sawing, shearing, or plasma cutting.
   3. Fasten members in full compliance with instructions of manufacturer. Wire tying of framing members is not permitted.

B. Tolerances: Fabricate trusses to maximum allowable tolerance variation from plumb, level and true line of 1/8 inch in 10 feet (1:1000).
   1. Up to 30 feet (9 m) Long: Maximum plus or minus 1/2 inch (12 mm) from design length.
   2. Over 30 feet (9 m) Long: Maximum plus or minus 3/4 inch (19 mm) from design length.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install cold-formed steel trusses in strict accordance with manufacturer's instructions and approved shop drawings, using approved fastening methods.

B. Install temporary erection bracing and permanent bracing and bridging before application of any loads. Erect trusses with plane of truss webs vertical and parallel to each other, accurately located at spacing indicated. Anchor trusses securely at bearing points.

C. Adequately distribute applied loads to avoid exceeding the carrying capacity of any one joint, truss, or other component.

D. Exercise care to avoid damaging truss members during lifting and erection and to minimize horizontal bending of trusses.

E. Removal, cutting, or alteration of any truss chord, web, or bracing member in the field is prohibited, unless approved in advance by Architect or the engineer of record and the truss manufacturer.

F. Repair or replace damaged members and complete trusses as directed and approved in writing by Architect or the engineer of record and the truss manufacturer.

G. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

H. Roof Trusses:
   1. Comply with recommendations of CFSEI 5000.
   2. Align truss bottom chords with load-bearing studs or continuously reinforce track as required to transfer loads to structure.
   3. Install continuous bridging and permanent truss bracing as indicated.
   4. Install roof cross bracing and diagonal bracing as indicated.

3.02 TOLERANCES

A. Install trusses to maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet (1:1000).

B. Space individual trusses not more than plus or minus 1/8 inch (3.2 mm) from plan location. Cumulative error in placement may not exceed minimum fastening requirements of sheathing or other material fastened to trusses.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 014000 - Quality Requirements.

3.04 PROTECTION

A. Protect trusses from damage by subsequent construction activities.

B. Repair or replace damaged trusses, truss members, and bracing members; obtain approval in advance by Architect or the engineer of record and the truss manufacturer for all cutting, repairs, and replacements.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof-mounted curbs.

B. Roofing nailers.

C. Miscellaneous framing and sheathing.

D. Communications and electrical room mounting boards.

E. Concealed wood blocking, nailers, and supports.

F. Miscellaneous wood nailers, furring, and grounds.

1.02 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

C. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association; 2012.

D. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2010.

E. SPIB (GR) - Grading Rules; Southern Pine Inspection Bureau, Inc.; 2002.

1.03 SUBMITTALS

A. Product Data: Provide technical data on wood preservative materials.

B. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

C. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of walls, soffits, members, openings, attachments, and fasteners as required.
2. Connections not detailed.

1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
3. Plywood exposed to the exterior shall be exterior type, A grade on both exposed and on concealed faces. PS1, A-C Grade where exposed.
4. Dimension lumber and plywood shall be thoroughly seasoned, non-treated, well-fabricated materials.

2.02 DIMENSION LUMBER

A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:

1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.
3. Wood Blocking: Minimum of 2x6, required for wall hung cabinets.
4. Metal Blocking: Can only be used for floor cabinets.

2.03 TIMBERS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry (23 percent maximum).

C. Beams and Posts 5 inches and over in thickness:

1. Species: Spruce-Pine-Fir (South).
2. Grade: Select Structural.

2.04 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. See drawings for wall and roof sheathing and connections.

2.05 ACCESSORIES

A. Fasteners and Anchors:

1. Metal and Finish: Where rough carpentry is exposed to weather, in contact with earth, pressure-preservative treated, or in area of high relative humidity, use fasteners with hot dip zinc coating or Type 304 stainless steel.
2. Expansion Anchors: Toggle bolt type for anchorage to hollow masonry.
   a. Masonry assemblies: Sustain load equal to 6 times load imposed when installed in unit.
   b. Concrete assemblies: Sustain load equal to 4 times load imposed when installed in unit.
3. Interior applications: Use carbon steel or zinc-plated components.
4. Exterior and wet applications: Use Stainless Steel components, Alloy Group 1 or 2.

2.06 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

B. Fire-retardant Treated Lumber and Plywood (FRT) shall be free of halogens, sulfates, chlorides, arsenic, ammonium phosphate, formaldehyde, and urea formaldehyde and kiln-dried after treatment.

C. FRT material for exterior and wet locations shall be natural wood products treated to add fire-retardant qualities plus decay and termite resistance, and non-leaching treatment under direct exposure to precipitation, sunlight, and effects of weather.

D. Natural wood products treated to add decay and termite resistance shall be compatible with direct exposure to precipitation, sunlight and effects of weather.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AFPA Wood Frame Construction Manual.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Specifically, provide the following non-structural framing and blocking:

1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Construct curb members of single pieces.

C. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.

3.06 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.07 SCHEDULES

A. Roof Blocking: S/P/F species, 19 percent maximum moisture content, pressure preservative treatment.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Wood door frames, glazed frames.

C. Wood casings and moldings.

D. Hardware and attachment accessories.

1.02 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.

C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

E. AWI (QCP) - Quality Certification Program, www.awiqcp.org; current edition at www.awiqcp.org.

F. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).

G. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; Hardwood Plywood & Veneer Association; 2004.

H. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:

1. Provide data on fire retardant treatment materials and application instructions.
2. Provide instructions for attachment hardware and finish hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Minimum Scale of Detail Drawings: 1-1/2 inch to 1 foot.

D. Samples: Submit two samples of finish plywood, 6x6 inch in size illustrating wood grain and specified finish.

E. Samples: Submit two samples of wood trim 12 inch long.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with AWI Architectural Woodwork Quality Standards Illustrated, Custom grade.

B. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Single Source Responsibility: Provide and install this work from single fabricator.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

1.06 PROJECT CONDITIONS

A. Sequence Installation to ensure utility connections are achieved in an orderly and expeditious manner.

B. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

PART 2 PRODUCTS

2.01 PLASTIC LAMINATE MATERIALS

A. Plastic Laminate: NEMA LD 3, HGS.

B. Manufacturers:

1. To be selected by Architect – see finish schedule.

C. Colors:

1. To be selected by Architect – see finish schedule.

D. Substrate for Wet Areas:

1. Provide plywood produced by a member of the American Plywood Association, DFPA tested, Marine grade.
2. Plywood shall be as manufactured by Georgia Pacific, US Plywood, Weyerhaeuser or an approved equal.
3. Openings for sinks shall be sealed with a waterproof sealant when cut.

E. Laminate Backing Sheet: NEMA LD 3, BKL; undecorated plastic laminate.

2.02 SOLID SURFACE MATERIALS

A. Manufacturers:

1. To be selected by Architect – see finish schedule.

B. Colors:

1. To be selected by Architect – see finish schedule.

2.03 HINGES AND BASEPLATES

A. For 3/4" thick doors:

1. 170 degree opening hinge, used in conjunction with baseplate, zinc die cast.Two-piece, wing type.

B. Number of hinges per door shall depend on weight and size of door.

1. Following information is only a guideline and it is the responsibility of the contractor to ensure that a sufficient number of hinges to prevent sagging or binding.

NUMBER OF HINGES	DOOR HEIGHT	DOOR WEIGHT
2	LESS THAN 36"	LESS THAN 15 LBS
3	LESS THAN 66"	LESS THAN 30 LBS
4	LESS THAN 84"	LESS THAN 45 LBS
5	LESS THAN 96"	LESS THAN 60 LBS

2.04 PULLS

A. Shall be stain aluminum pulls with Lock-Tite at screw connections.

2.05 DRAWER SLIDES

A. Provide full-extension bottom/side drawer slides for all file type drawers.

1. Provide ¾ slides for all other locations.

2.06 DRAWER LOCKS

A. Provide 5-pin tumbler, keyed per user requirements or minimally all locks shall be keyed alike in a given unit/department where requested.

2.07 HANDRAIL

A. Shall be plain sawn oak or maple when wood is approved for use.

2.08 SHELVING

A. Shall be minimum ¾" thick with melamine finish and PVC edge molding for cabinet shelving.

B. Provide plastic laminate for exposed shelving with PVC edge molding.

C. Provide metal L-shaped support pins/brackets for adjustable shelves.

2.09 LUMBER MATERIALS

A. Softwood Lumber: Alder or Birch species, maximum moisture content of 6 percent; with vertical grain, No. 1 grade.

B. Hardwood Lumber: Alder or Birch species, maximum moisture content of 6 percent;; with vertical grain No.1 grade.

2.10 SHEET MATERIALS

A. Softwood Plywood: PS 1 Grade A-B; Veneer core; species as selected.

B. Hardwood Plywood: HPVA HP-1, Grade AA, Type; Veneer core, type of glue recommended for application; species as selected.

C. Particleboard: ANSI A208.1; composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.

D. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth one side (S1S).

E. Pegboard: Pressed wood fiber with resin binder, standard grade; 1/8 in thick, with holes spaced at 1 in on center in both directions.

2.11 ADHESIVE

A. Adhesive: Type recommended by laminate manufacturer to suit application.

2.12 FASTENERS

A. Fasteners: Of size and type to suit application; finish as selected.

1. Concealed Joint Fasteners: Threaded steel.

2.13 ACCESSORIES

A. Plastic Edge Trim: Extruded convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness; color as selected.

B. Aluminum Edge Trim: Extruded convex shape; smooth surface finish; self locking serrated tongue; of width to match component thickness; natural mill finish.

C. Glass: Type as specified in Section 08800.

D. Primer: Alkyd primer sealer type.

E. Wood Filler: Solvent base, tinted to match surface finish color.

2.14 HARDWARE

A. General: Provide cabinet hardware and accessory materials for a complete installation or architectural woodwork.

B. Comply with BHMA A156.9.

2.15 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Fit exposed sheet material edges with matching hardwood edging. Use one piece for full length only.

C. Cap exposed plastic laminate finish edges with material of same finish and pattern.

D. Shop prepare and identify components for book match grain matching during site erection.

E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

F. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

G. Apply laminate backing sheet to reverse face of plastic laminate finished surfaces.

2.16 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 5 - Finishing for Grade specified and as follows:

1. Transparent:

a. System - 1, Lacquer, Nitrocellulose.

b. Stain: As selected by Architect.

c. Sheen: Flat.

E. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install millwork only when normal temperature and humidity conditions approximate interior conditions that will exist when building is occupied.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. Install hardware in accordance with manufacturer's instructions.

3.03 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.

B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.04 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.05 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 07 21 00
BATT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass blanket insulation; flexible.

1.02 REFERENCE STANDARDS

A. ASTM E 84 – “Standard Test Method for Surface Burning Characteristics of Building Materials.”

B. ASTM C 518 – “Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.”

C. UL 723 – “Standard for Test for Surface Burning Characteristics of Building Materials.”

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency as required for each product.

1.04 QUALITY ASSURANCE

A. Surface Burning Characteristics: For insulation and related materials UL/ULC Classified per UL 723 or meeting ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame spread index of 25 or less, and smoke developed index of 50 or less.
2. Insulation Installed Outdoors: Flame spread index of 75 or less, and smoke developed index of 150 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 PRODUCTS

2.01 FIBERGLASS BLANKET INSULATION

A. Unfaced, Fiberglass Blanket Insulation: ASTM C 665, Type I; with maximum flame spread and smoke developed indexes of 25 and 50, respectively per UL 723; passing ASTM E 136 for combustion characteristics; manufactured using a bio-based binder.

1. Basis-of-Design Product: Knauf Insulation; EcoBatt, Unfaced Batts.
2. R-value per plans and specifications.

B. Kraft Faced, Fiberglass Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier); manufactured using a bio-based binder.

1. Basis-of-Design Product: Knauf Insulation; EcoBatt, Kraft Faced Batts.
2. R-value per plans and specifications.

C. Reinforced Foil Faced, Fiberglass Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim kraft; manufactured using a bio-based binder.

1. Basis-of-Design Product: Knauf Insulation; EcoBatt, FSK Faced Batts.
2. R-value per plans and specifications.

D. Foil Faced, Fiberglass Blanket Insulation: ASTM C 665, Type III (reflective faced), Class B (faced surface with a flame propagation resistance of 0.12 W/sq. cm); Category 1 (membrane is a vapor barrier), faced with standard foil facing (no scrim reinforcement); manufactured using a bio-based binder.

1. Basis-of-Design Product: Knauf Insulation; EcoBatt, Standard Foil Faced Batts.
2. R-value per plans and specifications.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.02 GENERAL INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.03 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Fiberglass Blanket Insulation: Install in cavities formed by framing members according to the following requirements.

   a. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

   b. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

   c. Fiberglass insulation shall be installed in six sided cavities, meaning that no surface of the insulation shall be left exposed.

   d. Maintain 3 inches (76 mm) of clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

   e. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.

   f. For metal framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

   g. For wood framed construction, install blankets according to ASTM C 1320 and as follows:

      i. With faced batts or blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members. When using staple-free (no stapling flanges) kraft faced batts or blankets, insert the product into the cavity to produce a friction fit between the edges of the insulation and adjoining framing members.

      ii. With faced blankets having stapling flanges and the preferred application is to face staple the flanges, lap batt or blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

   b. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

i. Fiberglass Blankets: Measure and cut to desired measurement so as to fill gap completely with contact on all sides of surrounding insulation and no compression to finished thickness of material.

END OF SECTION

SECTION 07 21 10

SOUND ATTENUATION BATTS

PART 1 GENERAL

1.01 SUMMARY

A. Provide glass fiber acoustical insulation for interior partitions as indicated in building plans.

1.02 RELATED SECTIONS

A. Section 09 26 00 - Gypsum Board Assemblies

B. Section 09 10 00 - Non-Loadbearing Metal Framing

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM).

1. C 665 Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
2. E 84 Test Method for Surface Burning Characteristics of Building Materials.
3. E 136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.

B. C 518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter.

1. C423 Test Method for Sound Absorption Coefficient by the Reverberation Room Method.

1.04 SUBMITTALS

A. Product Data: Submit product literature, samples and installation instructions for specified insulation.

1.05 DELIVERY, STORAGE AND HANDLING

A. Protect insulation from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

1. Label insulation packages to include material name, production date and/or product code.
2. Deliver and store materials under provision of Section 01 60 00 - Product Requirements.

1.06 LIMITATIONS

A. Do not use unfaced insulation in exposed applications where there is potential for skin contact and irritation.

1. Kraft and standard foil facings will burn and must not be left exposed. The facing must be installed in substantial contact with the unexposed surface of the ceiling, wall or floor finish. Protect facing from any open flame or heat source.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Owens-Corning.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SOUND ATTENUATION BATTS

A. Unfaced glass fiber acoustical insulation complying with ASTM C 665, Type I.

B. Size: To fill entire wall cavity.

1. Thickness Width Length
2. 6" 152mm 16" 406mm 24" 609mm x wall height
3. 31/2” 89mm 16” 406mm 24’ 609mm x wall height

4. 2½" 64mm 16" 406mm 24" 609mm x wall height
5. Surface Burning Characteristics:
    a. Maximum flame spread: 10
    b. Maximum smoke developed: 10 when tested in accordance with ASTM E 84.
6. Combustion Characteristics: Passes ASTM E 136.

C. Fire Resistance Ratings: Passes ASTM E 119 as part of a complete fire tested wall assembly.
1. Select STC from Wall System Chart included in the ProSpec Introduction & Instruction Package.
2. Dimensional Stability: Linear Shrinkage less than 0.1%
3. Insulation must be approved for use within air plenums.

PART 3 EXECUTION

3.01 INSPECTION AND PREPARATION

A. Examine substrates and conditions under which insulation work is to be performed. A satisfactory substrate is one that complies with requirements of the section in which substrate and related work is specified.
1. Verify mechanical and electrical services within the shaft wall have been tested and inspected.

B. Obtain installer's written report listing conditions detrimental to performance of work in this section. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.
1. Clean substrates of substances harmful to insulation.

3.02 INSTALLATION - GENERAL

A. Comply with manufacturer's instructions for particular conditions of installation in each case.

B. Batts may be friction-fit in place until the interior finish is applied. Install batts to fill entire stud cavity. If stud cavity is less than 96" in height, cut lengths to friction-fit against floor and ceiling tracks. Walls with penetrations require that insulation be carefully cut to fit around outlets, junction boxes and other irregularities.
1. Where walls are not finished on both sides or insulation does not fill the cavity depth, supplementary support must be provided to hold product in place.
2. Where insulation must extend higher than 8 feet, temporary support can be provided to hold product in place until the finish material is applied.

3.03 GYPSUM BOARD INSTALLATION

A. Refer to Section 09 26 00 for proper installation of gypsum board.

3.04 PROTECTION

A. Protect installed insulation as recommended by manufacturer.

END OF SECTION

SECTION 07 21 40
RIGID INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rigid insulation and integral vapor retarder at cavity wall construction, perimeter foundation wall, and underside of floor slabs.

1.02 RELATED SECTIONS

A. Section 04 81 00 – Unit Masonry Assemblies.

B. Section 04 81 60 – Masonry Veneer.

1.03 REFERENCES

A. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

B. ASTM C 1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Termal Insulation Board.

C. ASTM D 2842 – Standard Test Method for Water Absorption of Rigid Cellular Plastics.

D. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. See Section 01 30 00 – Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.06 SEQUENCING

A. Sequence work to endure fireproofing and firestop materials are in place before beginning work of this section.

PART 2 PRODUCTS

2.01 BOARD INSULATION MATERIALS

A. Extruded Polystyrene Board Insulation: ASTM C 578, Type X; Extruded expanded polystyrene board with cut cell surfaces; with the following characteristics:

1. Board Size: 24 x 96 inch.
2. Board Thickness: 2inch (or as indicated)
3. Board Edges: Square.
4. Compressive Resistance: 25 psi.
5. Board Density: 1.3 lb/cu ft.
6. Water Absorption, maximum: 0.3 percent, volume.
7. Surface Burning Characteristics: Flame spread/Smoke developed of 5/45-175 in accordance with ASTM E 84.
8. Manufacturers:
    a. Dow Chemical Co.
    b. Owens Corning Corp.
    c. Tenneco Building Products.
9. Substitutions: See Section 01 60 00 – Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT CAVITY WALLS

A. Secure impale fasteners to substrate at a frequency as follows:

1. 6 per insulation board.

B. Install boards to fit snugly between wall ties.

C. Install boards horizontally on walls.

1. Place boards to maximize adhesive contact.
2. Install in running bond pattern.
3. Butt edges and ends tightly to adjacent boards and to protrusions.
4. Place impale fastener locking discs.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLTION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.04 PROTECTION OF FINISHED WORK

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 24 00
EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Composite wall and soffit cladding of rigid insulation and reinforced finish coating over cementitious base coat ("Class PM").

B. Drainage and water-resistive barriers behind insulation board.

1.02 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Sheathing on metal studs.

B. Section 06 1000 - Rough Carpentry: Sheathing on wood framing.

C. Section 07 6200 - Sheet Metal Flashing and Trim: Perimeter flashings.

D. Section 07 9005 - Joint Sealers: Perimeter and penetration sealants.

1.03 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2011.

B. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2011be1.

D. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2012a.

E. ASTM C1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage; 2009.

F. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive; 2005 (Reapproved 2010).

G. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity; 2011.

H. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

K. ASTM E1677 - Standard Specification for an Air Barrier (AB) Material or System for Low-Rise Framed Building Walls; 2011.

L. ASTM E2273 - Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies; 2003 (Reapproved 2011).

M. ASTM E2486 - Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS); 2006.

N. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2004 (Reapproved 2010).

O. ASTM G155 - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2005a.

P. ICC-ES AC219 - Acceptance Criteria for Exterior Insulation and Finish Systems; 2009.

Q. NFPA 259 - Standard Test Method for Potential Heat Building Materials; 2009.

R. NFPA 268 - Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source; 2012.

S. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate wall and soffit joint patterns, joint details, and molding profiles.

C. Product Data: Provide data on system materials, product characteristics, performance criteria, and system limitations.

D. Selection Samples: Submit manufacturer's standard range of samples illustrating available coating colors and textures.

1.05 QUALITY ASSURANCE

A. Maintain copy of specified installation standard and manufacturer's installation instructions at project site at all times during installation.

B. EIFS Manufacturer Qualifications: Provide all EIFS products other than insulation from the same manufacturer with qualifications as follows:
   1. Manufacturer of EIFS products for not less than 20 years.

C. Installer Qualifications: Company specializing in EIFS work, with not less than five years of documented experience, and approved by the EIFS manufacturer.

1.06 MOCK-UP

A. Construct mock-up of typical EIFS application on specified substrate, size 2'x2', and including flashings, joints, and edge conditions.

B. Locate mock-up where directed.

C. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to project site in manufacturer's original, unopened containers with labels intact. Inspect materials and notify manufacturer of any discrepancies.

B. Storage: Protect adhesives and finish materials from freezing and temperatures in excess of 90 degrees F.
   1. Protect Portland cement based materials from moisture and humidity. Store under cover off the ground in a dry location.
   2. Protect insulation materials from exposure to sunlight.

1.08 FIELD CONDITIONS

A. Do not prepare materials or apply EIFS during inclement weather unless areas of installation are protected. Protect installed EIFS areas from inclement weather until dry.

B. Do not install coatings or sealants when ambient temperature is below 40 degrees F.

C. Do not leave installed insulation board exposed to sunlight for extended periods of time.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's standard material warranty, covering a period of not less than 5 years.

C. Provide separate warranty from installer covering labor for repairs or replacement for a period of not less than 5 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Basis of Design: Dryvit Systems, Inc; Dryvit Outsulation LCMD Exterior Insulation and Finish Systems 4 and 5, Class PB with Moisture Drainage: www.dryvit.com.
   2. Parex USA, Inc.; Parex Standard WaterMaster EIFS: www.parex.com.
   3. BASF Wall Systems (Senergy, Finestone, Acrocrete, SonoWall): www.wallsystems.basf.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 EXTERIOR INSULATION AND FINISH SYSTEM

A. Exterior Insulation and Finish System: DRAINAGE type; reinforced finish coating on mechanically-fastened insulation board over sheet-type combination drainage layer/water-resistive barrier over substrate; provide a complete system that has been tested to show compliance with the following characteristics; include all components of specified system and substrate(s) in tested samples.

B. Fire Characteristics:
   1. Flammability: Pass, when tested in accordance with NFPA 285.
   2. Ignitibility: No sustained flaming when tested in accordance with NFPA 268.
   3. Potential Heat of Foam Plastic Insulation Tested Independently of Assembly: No portion of the assembly having potential heat that exceeds that of the insulation sample tested for flammability (above), when tested in accordance with NFPA 259 with results expressed in Btu per square foot.

C. Water Penetration Resistance: No water penetration beyond the plane of the base coat/insulation board interface after 15 minutes, when tested in accordance with ASTM E331 at 6.24 psf differential pressure with tracer dye in the water spray; include in tested sample at least two vertical joints and one horizontal joint of same type to be used in construction; disassemble sample if necessary to determine extent of water penetration.

D. Drainage Efficiency: Average minimum efficiency of 90 percent, when tested in accordance with ASTM E2273 for 75 minutes.

E. Salt Spray Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 300 hours exposure in accordance with ASTM B117, using at least three samples matching intended assembly, at least 4 by 6 inches in size.

F. Freeze-Thaw Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 10 cycles, when tested in accordance with ICC-ES AC 219 or 235.

G. Weathering Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 2000 hours of accelerated weathering conducted in accordance with ASTM G153 Cycle 1 or ASTM G155 Cycle 1, 5, or 9.

H. Water Degradation Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 14 days exposure, when tested in accordance with ASTM D2247.

I. Mildew Resistance: No growth supported on finish coating during 28 day exposure period, when tested in accordance with ASTM D3273.

J. Abrasion Resistance Of Finish: No cracking, checking or loss of film integrity when tested in accordance with ASTM D968 with 500 liters of sand.

K. Impact Resistance: Construct system to provide the following impact resistance without exposure of broken reinforcing mesh, when tested in accordance with ASTM E2486:
   1. Medium: 50 to 89 in-lb, for all area.

2.03 MATERIALS

A. Metallic Finish Coating Top Coat: Water-based, air curing, acrylic finish with integral color and texture.
   1. Texture: Fine.
   2. Color: As selected by Architect.

B. Base Coat: Acrylic- or polymer-modified, fiber reinforced Portland cement coating.
   1. Portland Cement: ASTM C150, Type I or II.
   2. Base Coat Thickness: 1/4 inch, minimum.

C. Reinforcing Mesh: Balanced, open weave glass fiber fabric, treated for compatibility and improved bond with coating, weight, strength, and number of layers as required to meet required system impact rating.

D. Insulation Board: Molded, expanded polystyrene board; ASTM C578, Type I; with the following characteristics:
   1. Board Size: 24 by 48 inches.
   2. Board Size Tolerance: plus/minus 1/16 inch from square and dimension.
   3. Board Thickness: 1-1/2 inches.
   4. Thickness Tolerance: plus/minus 1/16 inch maximum.
   5. Board Edges: Square.
   6. Thermal Resistance (R factor per 1 in (25.4 mm)) at 75 degrees F: 3.60.
   7. Board Density: 0.9 lb/cu ft.
   8. Compressive Resistance: 10 psi.
   9. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, when tested in accordance with ASTM E84.

E. Combination Drainage Layer/Water-Resistive Barrier: Air- and water-resistive sheet complying with ASTM E1677 Type I, dimpled or otherwise profiled to maintain air and drainage space between insulation board and sheathing; MINIMUM water vapor permeance of 20 perms; furnished or approved by EIFS manufacturer.

F. Exterior Cementitious Fiber-Mat Reinforced Sheathing, complying with ASTM C1325.

PART 3 EXECUTION

3.01 GENERAL

A. Install in accordance with EIFS manufacturer's instructions and ASTM C1397.

B. Where different requirements appear in either document, comply with the most stringent.

C. Neither of these documents supercedes the provisions of the Contract Documents that define the contractual relationships between the parties or the scope of work.

3.02 EXAMINATION

A. Verify that substrate is sound and free of oil, loose materials, or protrusions that could interfere with EIFS installation and is of a type and construction that is acceptable to EIFS manufacturer. Do not begin work until substrate and adjacent materials are complete and thoroughly dry.

B. Verify that substrate surface is flat, with no deviation greater than 1/4 in when tested with a 10 ft straightedge.

3.03 PREPARATION

A. Install self-furring metal lath over solid substrates that are deemed unacceptable to receive adhesively applied insulation. Install in accordance with ASTM C1063, except for butt-lapping instead of overlapping..
   1. Attach to concrete and concrete masonry using corrosion-resistant power or powder actuated fasteners or hardened concrete stub nails not less than 3/4 inch long and with heads not less than 3/8 inch wide. Ensure that fasteners are securely attached to substrate and spaced at maximum 16 inches on center horizontally and 7 inches vertically.

3.04 INSTALLATION - WATER-RESISTIVE BARRIER

A. Mechanically attach sheet materials to substrate using fasteners and fastener spacing recommended by EIFS manufacturer.

B. Seal all substrate transitions and intersections with other materials to form continuous water-resistive barrier on exterior of sheathing, using method recommended by manufacturer.

C. At door and window openings, seal water-resistive barrier to rough opening structure before installation of metal flashings, sills, or frames, using method recommended by manufacturer.

D. Lap flashing tape at least 2 inches on each side of joint or transition.

3.05 INSTALLATION - INSULATION

A. Install in accordance with manufacturer's instructions.

B. Install back wrap reinforcing mesh at all openings and terminations that are not to be protected with trim.

C. On wall surfaces, install boards horizontally.

D. Place boards in a method to maximize tight joints. Stagger vertical joints and interlock at corners. Butt edges and ends tight to adjacent board and to protrusions. Achieve a continuous flush insulation surface, with no gaps in excess of 1/16 inch.

E. Rasp irregularities off surface of installed insulation board.

F. Mechanical Fastening: Space fasteners as recommended by EIFS manufacturer.

3.06 INSTALLATION - FINISH

A. Base Coat: Apply in thickness as necessary to fully embed reinforcing mesh, wrinkle free, including back-wrap at all terminations of the EIFS. Install reinforcing fabric as recommended by EIFS manufacturer.
   1. Lap reinforcing mesh edges and ends a minimum of 2-1/2 inches.
   2. Allow base coat to dry a minimum of 24 hours before next coating application.

B. Apply finish coat after base coat has dried not less than 24 hours, embed finish aggregate, and finish to a uniform texture and color.

C. Apply sealant at finish perimeter and expansion joints in accordance with Section 07 9005.

3.07 CLEANING

A. Clean EIFS surfaces and work areas of foreign materials resulting from EIFS operations.

3.08 PROTECTION

A. Protect completed work from damage and soiling by subsequent work.

END OF SECTION

SECTION 07 25 00
SELF ADHERED WATER RESISTIVE BARRIER (WRB)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Self-adhered water resistive and air barrier membrane

1.2 RELATED SECTIONS

A. Section 01 35 43 – Environmental Procedures, including airtightness and blower door testing requirements
B. Section 07 20 00 – Thermal Protection.
C. Section 07 27 01 – Interior air and vapor control layer
D. Section 07 27 02 – Airtight tapes
E. Section 07 30 70 – Roof underlayment materials

1.3 REFERENCES

A. EN 1849-2 — Flexible sheets for waterproofing. Determination of thickness and mass per unit area. Plastics and rubber sheets for roof waterproofing
B. ASTM E331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
C. ASTM E2357 – Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies
D. ASTM E96 – Standard Test Method for Water Vapor Transmission of Materials
E. EN ISO 12572 - Hygrothermal performance of building materials and products
F. EN 20811 – Textiles - Determination of resistance to water penetration - Hydrostatic pressure test
G. American Association of Textile Chemists and Colorists (AATCC): ATCC 127 - Test Method for Water Resistance: Hydrostatic Pressure Test.
H. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
I. EN 1109 – Flexible sheets for waterproofing - Determination of flexibility at low temperature
J. EN 1296- Flexible sheets for waterproofing - Method of artificial ageing by long term exposure to elevated temperature
K. EN 1297 - Flexible sheets for waterproofing - Method of artificial ageing by long term exposure to the combination of UV radiation, elevated temperature and water

1.4 SYSTEM DESCRIPTION

A. Self-adhering, monolithic, vapor permeable membrane, durable weather resistive barrier or roof underlayment. It doubles as a continuous air barrier and rainscreen waterproofing with active vapor diffusion featuring a TEEE vapor-open membrane actively transports vapor outward by passing it along a molecular chain within. Non porous, completely waterproof and airtight, and is compliant with IBC 1403 and R703 as a tested WRB.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Submittal Procedures.
B. Product Data: Manufacturer's data sheets, including:
   1. Installation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
C. Verification Samples: Membrane, minimum 4 x 6”.

1.6 QUALITY ASSURANCE

A. Performance target: Completed installation must achieve the required airtightness performance level for this project as specified in Section 01 35 43.
B. Installer Qualifications: Comply with one of the following requirements:

1. The (sub-)contractor installing the weather resistive barrier shall have experience with installation of weather barrier assemblies under similar conditions and have achieved blower door tested airtightness of 1.0 ACH50 or 0.1 CFM/SF75 envelope leakage or better in a previous project.

D. Mock-Up: Provide a mock-up for evaluation of installation techniques and application workmanship.
   1. Prior to installation of WRB, mock up installation as follows to verify details and to demonstrate connections to adjoining construction elements, and other termination conditions.
   2. Install mockup in location designated by Architect.
   3. Do not proceed with remaining work until workmanship and application technique are approved by Architect.
   4. Construct typical exterior wall, 8 feet wide by 8 feet long, illustrating materials interface and connections (tape, adhesives, and gaskets), incorporating specified options including but not limited to the following:
      a. Junctions of walls, foundations, ceilings, floors and roof,
      b. Corner condition, and
      c. Window and doorframe connections

E. Cooperate and coordinate with the owner's inspection. Do not install any elements of the exterior wall in the mock-up that would restrict access to the WRB until it has been inspected, and approved.

1.7 PRECONSTRUCTION MEETING

A. Preconstruction Meeting: Convene a meeting with all subcontractors affected by the Work of this Section a minimum of one week prior to commencing work of this section. Agenda shall include materials, details of construction, compatibility of materials, sequencing of construction/installation of membranes, WRB application.

B. Coordinate Work with other subcontractors (plumbers, electricians, carpenters, HVAC), operations and installation of finish materials to install correct-sized gaskets on pipes, ducts and cable when these elements pass through the WRB layer, and to avoid damage to installed materials. Before they commence work on site, provide each effected trade with sufficient gaskets.

C. After meeting, post the following warning in prominent locations in red – 1” letter height minimum. Translate into additional languages if required/as appropriate.

AIRTIGHT BUILDING PROJECT

This is an airtight building; **DO NOT PENETRATE** the insulated envelope and airtight layer without prior permission of the Superintendent

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials on pallets. in clean and dry areas, not exposed to direct sunlight and in accordance with manufacturer's instructions.

C. Protect materials during handling and application to prevent damage, puncturing or contamination.

1.9 PROJECT/SITE CONDITIONS

A. Allowable Weather/UV-exposure: Minimize exposure to direct sunlight. Maximum exposure of 3 months on roofs and 4 months on walls in climate zones 1-3, 6 months on walls and 4 months on roofs in climate zone 4+.

B. Minimum application temperature: 15°F (-10 ºC)

1.10 WARRANTY

A. Manufacturer’s Warranty: The manufacturer’s standard warranty is six years and includes replacement cost; however, the warranty can be extended to ten years when complying with Pro Clima warranty requirements. If possible, comply with manufacturer’s requirements to obtain the ten year warranty; if not possible, inform owner/architect.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Pro Clima/Moll bauökologische Produkte GmbH, 68723 Schwetzingen Germany. Imported by 475 High Performance Building Supply, 334 Douglass Street, Brooklyn NY, 11217; Tel: +1 800-993-6329; Email; info@foursevenfive.com; Web: www.foursevenfive.com

B. Substitutions: See Section 016000 - Product Requirements.

2.2 WEATHER RESISTIVE BARRIER SYSTEM

A. SOLITEX ADHERO 1000: self-adhering, monolithic, vapor permeable membrane, durable weather resistive barrier or roof underlayment OR EQUAL. Tested in accordance with ASTM E331 criteria modified to meet IBC 1403.2 Weather protection and IRC R703 Exterior covering requirements for weather resistive barriers having the following properties:

1. Materials: Monolithic TEEE membrane, with Polypropylene microfiber fleece; color — Dark Blue
2. Weight: 0.79 oz/ft² ; 240 g/m² (EN 1849-2)
3. Thickness: 28 mils ; 0.70 mm (EN 1849-2)
4. Water resistance: Passed 2 hours at 200 Pa (ASTM E 331)
5. Airtightness: 0.0009 CFM/ft2 (ASTM E2357 – penetrated wall)
6. Vapor Permeance: 8 Perms (ASTM E96), 11 Perms (EN ISO 12572)
7. Fire class: A FS:10 - SDI: 15 (ASTM E84)
8. Water column: over 32’10” (10m) (EN 20811/AATCC 127)
9. Temperature resistance: -40 °C/-40 °F to +100 °C/212 °F
10. Tensile strength: 250 N/5 cm / 200 N/5 cm ; 29 lb/in / 23 lb/in (EN 12311-1)
11. Durability after artificial ageing: Passed (EN 1297/ EN 1296)

B. Related system components:
1. Exterior seam tape: Airtight and waterproof TESCON VANA Solid Acrylic tape with PP carrying membrane.
2. Airtight window tape: TESCON PROFIL/PROFECT: Solid Acrylic tape with PP carrying membrane and split release paper for sealing windows and corners.

— O R —

3. Airtight window tape: CONTEGA SOLIDO IQ: Solid Acrylic tape with PP backing fleece and PP copolymer special membrane.
4. Windowsill/flashing tape: EXTOSEAL ENCORS - Acrylic modified butyl tape for window sills and flashing.
5. Airtight adhesive: CONTEGA HF: non-embrittling adhesives for membrane connections to concrete, rough surfaces and plywood floors.

— O R —

6. Liquid applied membrane: VISCONN: liquid applied air barrier

2.3 ACCESSORIES

A. PRESSFIX-XL tape pressurization tool.

B. Primer: TESCON Primer RP

C. Pipe, duct, cable sealing: ROFLEX and KAFLEX EPDM gaskets per specific pipe sizes.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates/surfaces have been properly prepared and cleaned from dust, silicones, oils and grease. Before installation, verify substrate is free of splinters, nails or other objects that could puncture membranes.

B. If window or door opening preparation is the responsibility of another installer, notify architect of unsatisfactory preparation before proceeding.

C. If there are unexpected pipes, ducts or wires in the installation area/airtight layer or these penetrations do not have gaskets around them, notify architect of unsatisfactory preparation before proceeding.

D. If floor, walls or beams interfere with the WRB layer, notify architect of unsatisfactory preparation before proceeding.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

F. Beginning of installation constitutes acceptance of existing conditions.

3.2 PREPARATION

A. Clean and prepare surfaces to receive WRB in accordance with manufacturer's installation guidelines.

B. All surfaces must be clean, smooth and dry and must be clean of oil, dust, and silicone.

C. Pretreat rough or porous surfaces such as concrete, CMU, wood fiber board insulation or substrates with insufficient stability with primer.

3.3 APPLICATION

A. Apply materials in accordance with manufacturer's instructions.

B. Do not install products under environmental conditions outside manufacturer's absolute limits as listed above.

C. Install membrane as soon as possible after sheathing is installed /exterior shell is completed.

D. Install membranes on top of the substrate without creases.

E. Overlap subsequent courses of membrane, using the printed lines on the membrane as a guide.

F. Overlap the membrane at least 4” over dissimilar airtight materials (concrete, plaster), use expansion loops when connections dissimilar materials and planes.

G. Pressurize membrane with broom/roller over entire surface immediately after application.

H. Leave some slack in the membrane to allow for expansion and contraction between dissimilar materials such as concrete, brick, plaster or rough OSB. Prime rough substrates with Primer if necessary. Do an adhesion test to verify the bond.

I. Cut membrane with a utility knife in detail around penetrations.

J. Seal membranes to windows, joists and beams with appropriate tape. Follow application guides and use pre-folded tape corners for inside corners.

K. Seal pipe, duct, cable, or similar penetrations with appropriate gaskets taped to WRB. Avoid creases in tape and shiplap from bottom up.

L. Inspect completed membrane installation before blower door or water infiltration test. Ensure:
   1. Each overlap is properly (ship-) lapped, taped and that tape has been properly pressurized.
   2. Battens are installed at recommended distances.
   3. Tears, and punctures have been repaired with appropriate tape.
   4. Windows, doors and penetrations are air sealed and waterproofed.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Repair damages, punctures or burns (e.g. from sweating copper pipe) and/or replace damaged products before covering materials.

C. To protect WRB, apply exterior insulation, battens and exterior finish as soon as possible, and not later than recommended weather exposure time for used product.

END OF SECTION

SECTION 07 26 00

VAPOR RETARDERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Provides building paper and flashing systems, including sealing joints and protrusions through building paper, with accessories as required for complete installation.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's literature for each type of building paper.

B. Samples: Submit samples of each type of building paper. Quality Assurance/Control Submittals: Submit either test reports or manufacturer's certificates indicating materials comply with specified requirements.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturers:

1. Fortifiber® Building Systems Group, 1-800-773-4777.
2. Stego Industries, LLC: 1-877-464-7834.
3. W.R. Meadows, Inc.: 1-800-342-5976.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Vapor Retarders (Underslab): 20 mil. Underslab Vapor Retarder, a 15-mil, extremely durable and puncture resistant polyolefin manufactured from ISO certified virgin resins.

1. Types:
   a. Premium: 20 mil. Underslab Vapor Retarder.
2. Reference Standard: ASTM E 1745-97 Class A; ASTM E 1745-97 Class B; ASTM E 1745.
3. Puncture Resistance: 3200 grams.
4. Water Vapor Permeance: less than .03 perms.

B. Accessories: Provide products recommended by building paper manufacturer for complete installation.

1. Adhesives: Types as recommended by building manufacturer for specific materials and application indicated.
2. Joint Sealers: Types as recommended by Vapor Retarders manufacturer, pressure sensitive tape or mastic as recommended by building paper manufacturer for specific material and application indicated.
3. Sealant: Types as recommended by Vapor Retarders manufacturer, polyurethane, one-component balanced modulus, moisture curing, nonsag elastomeric sealant.
   a. Reference Standards: AAMA 808.3-92 (Exterior Perimeter Sealing Compound); ASTM C-920 Type S, Grade NS, Class 25.
4. Penetration Seal: Type as recommended by Vapor Retarders manufacturer, pre-sized, multi-purpose penetration seal manufactured from puncture resistant polyolefin membrane.

PART 3 EXECUTION

3.01 PREPARATION

A. Ensure items which pass through building paper are properly and rigidly installed, substrate is free of projections and irregularities which may be detrimental to proper installation of building paper.

3.02 INSTALLATION

A. Apply building paper in accordance with manufacturer's recommendations, laid smooth without folds or bunches of material.

1. Seam Overlap: As recommended by building paper manufacturer for specific building paper material and application indicated.
2. Sealing: Seal edges and items projecting through vapor retarders and vapor barriers.

B. Inspect and repair building paper prior to application of finish material over building paper; tape tears, perforations and similar damage.

END OF SECTION

SECTION 07 26 19 - HUMIDITY DEPENDENT VAPOR RETARDERS

PART 1 - GENERAL.

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes Humidity Dependent Vapor Retarder (*smart vapor retarder, smart membrane, smart vapour control barrier*) and air-barrier sheet membrane systems.

B. Related Requirements:
   1. Division 07 Section - Thermal Insulation.
   2. Division 07 Section - Weather Barriers.
   3. Division 07 Section - Air Barriers.

1.03 REFERENCES

A. Definitions:
   1. ACH50: Air changes per hour at 50 Pascals pressure.
   2. CFM/SF75: Cubic Feet per Minute per Square Foot at 75 Pascals pressure.
   3. MD/CD: Machine direction/cross direction.
   4. Sd: Diffusion-equivalent air layer thickness or equivalent air layer thickness. A measure of how much resistance to moisture diffusion the medium has, when compared to a meter of air.

B. Reference Standards: Perform Work in accordance with standards specified and as follows unless modified by requirements in the Contract Documents.
   1. Maintain an on site a copy of each standard affecting the Work of this Section.
   2. American Society for Testing and Materials (ASTM):
      a. ASTM D3330**[-04(2018)]**: Standard Test Method for Peel Adhesion of Pressure-Sensitive Tape
      b. ASTM E84**[-2021a]**: Standard Test Method for Surface Burning Characteristics of Building Materials.
      c. ASTM E96**[-00e1]**: Standard Test Methods for Water Vapor Transmission of Materials.
   3. International Organization for Standardization (ISO):
      a. ISO 12572**[:2016]**:Hygrothermal performance of building materials and products - Determination of water vapour transmission properties - Cup method.
   4. National Fire Protection Association (NFPA):
      a. NFPA 101**[-2024]**: Life Safety Code.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a**t** Project site in accordance with Div. 01 Section minimum one week prior to commencing work of this Section.
   1. Attendees:
      a. Contractor and their superintendent.
      b. Owner
      c. Architect.

d. Humidity Dependent Vapor Retarder installer and their suppliers. Attendance may be remote/virtual.
e. Each trade involved with or affected by vapor retarder installation.

2. Agenda Review and discuss the following:
   a. Materials, details of construction, compatibility of materials, sequencing of construction, installation of vapor retarder.
   b. Air-tightness goal emphasizing the success of vapor retarder installation quality and blower door test is dependent on the collaboration of all trades.
   c. Ensuring insulation installation during winter months occurs immediately after vapor retarder installation.
3. After meeting, post the following warning in prominent locations at each building entrance and at top of each stair in minimum one inch (25 mm) high red letters.

AIRTIGHT BUILDING
No drilling, airtight construction: no cutting, airtight membranes. Report all penetrations to supervisor.

B. Coordination: In accordance with Div. 01 Section and as follows:
1. Coordinate the Humidity Dependent Vapor Retarder installation with other trades to install airtight tape and correct-sized gaskets on items penetrating the vapor retarder to avoid damage to installed materials.
2. Provide airtight tape and gaskets in sufficient quantities to each affected trade before their work begins.

1.05 SUBMITTALS, GENERAL

A. Process and transmit in accordance with Div. 01 Section

1.06 ACTION SUBMITTALS

A. Product Data: Submit **[**two**]** copies of manufacturer's data sheets for each type of product.

B. Samples: Submit **[two]** samples of each type of product planned for use for verification.
1. Sample Size:
   a. Primary Sheet Material: **[4 by 6]** inches (**[100 by 150] [___]** mm).
   b. Tapes: 4 inches (100 mm) long.

1.07 INFORMATIONAL SUBMITTALS

A. Manufacturers’ instructions.

B. Storage and handling requirements and recommendations.

C. Evaluation Service Reports (ESR) from ICC-ESR for Humidity Dependent Vapor Retarder showing compliance with ICC ESR-4845.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Comply with the following:
1. Company: An employer of workers and supervisors who have received product orientation by 475 High Performance Building Supply.
   a. Company shall have achieved independently tested blower door tested air tightness of 1.0 ACH50 or 0.15 CFM/SF75 envelope leakage or better in previous projects.

2. Project Experience: Minimum **[3]** years experience on at least **[two]** projects of similar scope and scale to this Project in past **[3]** years.
3. Staff: Employ a competent foreman to supervise Work of this Section. Foreman shall be present whenever Work is in progress.

B. Mockups: In accordance with Div. 01 Section and as follows:
1. Interior Mockup:
   a. Location: As directed
   b. Size: Floor to ceiling high by wall-to-wall space but not less than 20 feet long including a window opening.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products in accordance with manufacturer's written instructions and recommendations.

B. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

C. Store materials on pallets. in clean, dry areas. Avoid exposure to direct sunlight. Store adhesives and primers at temperatures at or above 40 degrees F (4 degrees C) to facilitate handling.

D. Protect materials during handling and application to prevent damage, puncturing or contamination.

1.10 FIELD CONDITIONS

A. Ambient Conditions: As follows:
1. Minimum Conditions: Do not install products under conditions outside manufacturer's limits.
2. Maintain temperature, humidity, and ventilation in accordance with manufacturers written instructions and recommendations.
   a. Maintain relative humidity at less than 60 percent in winter.
3. Minimize exposure of membranes to direct sunlight.
   a. Use blinds or covers over window openings to block direct sunlight to prevent UV damage to membranes,
   b. If interior-located membranes cannot be covered by gypsum wallboard or other material within two weeks installing the product.
4. Minimize exposure to water.

B. Long Term Temperature Resistance: -40 to 176 degrees F (-40 to 80 degrees C).

1.11 WARRANTY

A. Comprehensive Warranty: Furnish manufacturer's comprehensive warranty providing coverage against failures in materials as follows:
1. Component Warranty Period: Six years from date of sale of product.
2. System Warranty Period: Ten years from date of sale of product.

PART 2 - PRODUCTS.

2.01 MANUFACTURERS

A. Manufacturer: Pro Clima / MOLL bauoekologische Produkte GmbH, Rheintalstraße 35 - 43, 68723 Schwetzingen, Germany. exclusively distributed by 475 High Performance Building Supply, 369 Warren Street, Brooklyn, NY 11201; Tel: +1 800-993-6329; Email; info@475.supply;Web: www.475.supply.

B. Substitutions: See Section 016000 - Product Requirements.

2.02 PERFORMANCE CRITERIA

A. Humidity Dependent Vapor Retarder Assembly:
   1. The vapor retarder assembly shall be joined (taped or sealed) in an airtight manner to the adjacent airtight vapor retarder materials or assemblies.

B. Project's Air Tightness Goal: Less than or equal to **1.0** ACH50 or **0.40** CFM/SF75.

C. Water Vapor Diffusion (Equivalent Air Layer Thickness): As determined in accordance with ICC ES AC528 per ISO 12572 as follows:
   1. Dry cup test at 25 percent RH.
   2. Intermediate cup test at 70 percent RH.
   3. Inward drying test at high humidity (90 percent RH or higher).

2.03 HUMIDITY DEPENDENT VAPOR RETARDER SYSTEMS

A. Interior Humidity Dependent Vapor Retarder Membrane: An intelligent, vapor-variable (Hydrosafe ®) sheet membrane that changes its vapor permeability based on humidity levels; three layer material made from polyethylene copolymer membrane with polypropylene reinforcement grid and faced both sides with polypropylene microfiber fleece.
   1. Basis of Design Product: INTELLO PLUS by Pro Clima.
   2. Color: Translucent white.
   3. Thickness: 16 mils (0.4 mm ±0.1 mm) per EN1849-2.
   4. Temperature Exposure Limits: -40 to 176 degrees F (-40 to 80 degrees C).
   5. System Physical Properties:
      a. Per ICC ESR-4854 and ETA 18/1146.
      b. Surface Weight: 0.36 oz/sf (110 g/m2 - ±5g/m2) per EN 1849-2.
      c. Air Tight Material: 0.00005 cfm/sf (0.000000 L/Pa·sq m/s) per ASTM E2178.
      d. Vapor Variability: Sd 0.13m to 13m per ISO 12572.
      e. Perm Rating: 0.2 perms (dry cup) per ASTM E96.
      f. Permeability Consistent After Artificial Age Testing: Pass - per ETA 18/1146.
      g. Water Vapor Diffusion:
         1) Dry cup test at 25 percent RH: 39.4
         2) Intermediate cup test at 71.5 percent RH: 2.05
         3) Inward drying test at 90 percent RH: 0.49
      h. Tensile Strength: 39 lb/in MD / 25 lb/in CD (340 N/50 mm MD / 220 N/50 mm CD) per EN 13859-1 (A).
      i. Elongation at Break: 15 percent MD and CD per EN 13859-1.
      j. Nail Tear Resistance: 23 lb/in MD and CD (200 N/50 mm MD and CD) per DIN EN 13859-1 (B).
      k. Durability / Artificial Age Test: Per ETA 18/1146.
      l. Living Building Challenge Declare Label: Red List free.

6. Recycled Content:
   a. Fleece: Minimum 50% pre-consumer recycled content.
   b. Source: Internal manufacturing off-cuts reprocessed into new membrane fleece.

B. Interior Humidity Dependent Vapor Retarder Membrane: An intelligent, vapor-variable (Hydrosafe ®) sheet membrane that changes its vapor permeability based on humidity levels; three layer material made from polyethylene copolymer membrane with polypropylene reinforcement grid and faced both sides with polypropylene microfiber fleece.
1. Basis of Design Product: INTELLO X by Pro Clima.
2. Color: White.
3. Thickness: 18 mils (0.45 mm ±0.05 mm) per EN 1849-2.
4. Temperature Exposure Limits: -40 to 176 degrees F (-40 to 80 degrees C).
5. System Physical Properties:
   a. Per ICC ESR-4854 and ETA 18/1146.
   b. Surface Weight: 0.43 oz/sf (130 g/m^2) per EN 1849-2.
   c. Air Tightness: 0.00005 cfm/sf (0.000000 L/Pa·sq m/s) per ASTM E2178.
   d. Perm Rating: 0.2 perms (dry cup) per ASTM E96.
   e. Permeability Consistent After Artificial Age Testing: Pass - per ETA 18/1146.
   f. Water Vapor Diffusion:
      1) Dry cup test at 25 percent RH: 42.3
      2) Intermediate cup test at 71.5 percent RH: 1.84
      3) Inward drying test at 90 percent RH: 0.43
   g. Tensile Strength: 29 lb/in MD / 19 lb/in CD (250 N/50 mm MD / 170 N/50 mm CD) per EN 13859-1 (A).
   h. Elongation at Break: 60 percent MD and CD per DIN EN 13859-1.
   i. Nail Tear Resistance: 27 lb/in MD and CD (236 N/50 mm MD and CD) per DIN EN 13859-1 (B).
   j. Durability / Artificial Age Test: Per ETA 18/1146.
   k. Living Building Challenge Declare Label: Red List free.
   l. UV Exposure: 2 Months
6. Recycled Content:
   a. Fleece: Minimum 50% pre-consumer recycled content.
   b. Source: Internal manufacturing off-cuts reprocessed into new membrane fleece.

2.04 ACCESSORIES

A. Airtight Interior Tape: Solid acrylic tape with polypropylene carrying fleece.
1. Basis of Design Product: TESCON VANA by Pro Clima.
2. Physical Properties:
   a. Perm Rating: 8 per EN 1931.
   b. Adhesion: 4.45 lbf/lin. inch (0.503 N/m) on vapor retarder membrane, 3.34 lbf/lin. inch (0.377 N/m) on OSB per ASTM D3330.
   c. Artificial age test: 100 years per DIN 4108-7.
   d. Living Building Challenge Declare Label: Red List free.
   e. VOC: None.

B. Airtight Interior Corner Tape: Solid acrylic tape with polypropylene carrying fleece and split release paper.
1. Basis of Design Product: **TESCON PROFIL** by Pro Clima.
2. Physical Properties:
   a. Living Building Challenge Declare Label: Red List free.
   b. VOC: None.

C. Airtight Window Tape: Vapor retarding window tape with multiple release papers for specific or blind taped window airsealing.
1. Basis of Design Product: CONTEGA SOLIDO IQ(-D) by Pro Clima.

D. Airtight Adhesive: Non-embrittling adhesive for membrane connections to concrete, plywood floors, and very rough/split wood.
   1. Basis of Design Product: **CONTEGA Classic** by Pro Clima.

E. Liquid Applied Airtight Membrane: Aqueous acrylate polymer dispersion.
   1. Basis of Design Product: VISCONN or VISCONN FIBRE by Pro Clima.
   2. Physical Properties:
      a. Living Building Challenge Declare Label: Red List free.
      b. CPHD compliant

F. Primer for Brick or Concrete: Acrylic-copolymer based primer.
   1. Basis of Design Product: TESCON PRIMER RP by Pro Clima.
   2. Physical Properties:
      a. Material: Acrylic co-polymer
      b. Application Temperature: Above 15 degrees F (-10 degrees C).

G. Pipe, Duct, and Cable Sealing Gaskets: EPDM gaskets sized to fit required pipe sizes.
   1. Basis of Design Product: ROFLEX and KAFLEX by Pro Clima.

H. Battens: Softwood lumber as specified in Division 06 Sections.

PART 3 - EXECUTION.

3.01 EXAMINATION

A. Verification of Conditions: Examine substrates, areas, and conditions under which the vapor retarder assembly will be installed, with installer present, for compliance with the following requirements.
   1. Verify that surfaces and conditions are suitable prior to commencing work of this Section. If substrates are not acceptable, require substrate installer(s) to make necessary repairs and re-verify suitability.
   2. Verify substrates are dry and free of moisture, frost or ice.
   3. Verify surfaces are sound, dry, even, and free of contaminants including, but not limited to, oil, grease, dust, and silicone.
   4. Verify surfaces are smooth without large voids or sharp protrusions.
   5. Verify surfaces are free of splinters, nails, and other objects that could puncture membranes.
   6. Verify sealants are compatible with vapor retarder proposed for use.
   7. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.
   8. Do not proceed with installation until unsatisfactory conditions have been corrected.
   9. Beginning installation constitutes acceptance of substrate conditions.

3.02 PREPARATION

A. Surface Preparation: Clean and prepare substrate according to manufacturer's written instructions.
   1. Ensure substrates are suitable as verified in 3.01 for membrane and tape installation.
   2. Prime adjacent surfaces to receive tape as required by vapor retarder membrane manufacturer.
      a. Prime surfaces including, but not limited to, brick, concrete, wood, fiber insulation board, and OSB panels.
      b. Perform adhesion tests to ensure proper tape adhesion when substrate adhesion is in question.

B. Properly ventilate space or use dehumidifier to prevent high humidity conditions after concrete pours, gypsum board taping and bedding work, tile work, painting and similar moisture generating activities.

C. Install battens across stud and other cavities to support dense pack insulation against Humidity Dependent Vapor Retarder membranes. Space battens not more than 20 inches (500 mm) on center perpendicular to studs or cavities
   1. Apply dense pack insulation directly after installing interior airtight membranes.
   2. Install gypsum board as soon as possible, but no later than specified exposure limit of vapor retarder membrane and other materials. Use tarps or other means of blocking UV if exposure times will be exceeded to protect membranes.

3.03 INSTALLATION

A. Comply with manufacturer's written installation instructions and recommendations and approved submittals.

B. Install vapor retarder materials, including accessory materials, to provide continuity throughout the interior of the building envelope.
   1. Mechanically fasten membranes to framing and substrate in accordance with manufacturer's written instructions.
   2. Install membranes taut and without creases.
   3. Cut membrane with a utility knife around and close to penetrations.
   4. Install pipe, duct, and cable sealing gaskets at penetrations.
   5. Overlap subsequent courses of membrane four inches (100 mm) using the printed lines on the membrane as a guide.
      a. Tape membrane-to-membrane overlaps. Use tape application tool to ensure sufficient back-pressure when applying the pressure sensitive tapes.
      b. Ensure tape joints are supported by battens or by cross taping taped joints with 12 inch (305 mm) long pieces of tape at 12 inches (305 mm) on center to reduce tensile stress on tape.
   6. Overlap membranes not less than 2 inches (50 mm) onto adjacent airtight materials such as concrete, masonry, metals, plaster, and similar surfaces. Use expansion loops to allow dissimilar materials to expand/contract.
   7. Joint Sealing:
      a. Use airtight adhesive to adhere membranes to concrete, brick, plaster, and rough OSB. Leave some slack in the membrane to accommodate expansion and contraction between dissimilar membrane and tape materials.
      b. Seal membranes to windows, joist and beams with airtight window tape or airtight interior corner tape. Follow application guides of specific tapes.
      c. Tape around existing penetrations (pipes, ducts, cables, etc.) with airtight interior tape in overlapping, step like fashion. Avoid creases and fish-mouths in tape.

3.04 PROTECTION

A. Protect installed products until completion of Project.

B. Repair tears, punctures or burns (e.g. from sweating copper pipe) and/or replace damaged products before covering materials

END OF SECTION 07 26 19

SECTION 074113
METAL ROOF PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulated metal roof panel system of preformed steel panels.

B. Metal roof panel system of preformed aluminum panels.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Roof sheathing.

B. Section 072100 - Thermal Insulation: Rigid roof insulation.

C. Section 074213 - Metal Wall Panels: Preformed wall panels.

D. Section 079200 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.

E. Section 099113 - Exterior Painting: Field priming and painting roofing panels.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2026.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

C. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2025a.

D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

F. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2025.

G. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2025.

H. ASTM D4869/D4869M - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing; 2016a (Reapproved 2025).

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

J. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2025.

K. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2025.

L. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference; 1995 (Reapproved 2024).

M. ASTM E1680 - Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems; 2016 (Reapproved 2022).

N. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Summary of test results, indicating compliance with specified requirements.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Specimen warranty.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.
   2. Include structural analysis signed and sealed by qualified structural engineer, indicating compliance of roofing system to specified loading conditions.

D. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Test Reports: Indicate compliance of metal roofing system to specified requirements.

H. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section and with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Provide mock-up of 32 sq ft , including underlayment, eave protection membrane, and associated flashings.

C. Locate as directed by Architect.

D. Mock-up may remain as part of the work.

1.07 FIELD CONDITIONS

A. Do not install metal roof panels, eave protection membrane, underlayment, when surface, ambient air, or wind chill temperatures are below 45 degrees F (7 degrees C).

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

C. Special Warranty: Provide 2-year warranty for weathertightness of roofing system, including agreement to repair or replace metal roof panels that fail to keep out water commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Structural Metal Roof Insulated Panel Manufacturers:
   1. ATAS International, Inc; Isoleren RL: www.atas.com/#sle.
   2. Kingspan Insulated Panels; KingRib Insulated Roof Panel: www.kingspan.com/#sle.
   3. Metl-Span, a Nucor Company; ____: www.metlspan.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Architectural Metal Roof Panel Manufacturers:
   1. Metl-Span, a Nucor Company; ____: www.metlspan.com/#sle.
   2. Taylor Metal Products; Versa Span: www.taylormetal.com/#sle.
   3. Best Buy Metals; .
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:
   1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.
      a. Dead Loads: Weight of roofing system.
      b. Live Loads: As indicated on drawings.
   2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
   3. Wind Uplift: Class 90 wind uplift resistance of UL 580.
   4. Air Infiltration: Maximum 0.06 cfm/sq ft (1.1 cu m/hr/sq m) at air pressure differential of 6.24 lbf/sq ft (300 Pa), when tested according to ASTM E1680.
   5. Water Penetration: No water penetration when tested in accordance with procedures and recommended test pressures of ASTM E1646; perform test immediately following air infiltration test.
   6. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F (56 degrees C).

2.03 STRUCTURAL METAL ROOF PANELS

A. General: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Structural Insulated Metal Panels: Factory-formed panels with factory-applied finish.
   1. Type: Steel faced, polyisocyanurate foamed-in-place insulated roof panels .
   2. Steel Panels:
      a. Aluminum-zinc alloy-coated SS (structural steel) sheet complying with ASTM A792/A792M; minimum AZ50 (AZM150) coating.
      b. Steel Thickness: Minimum 24 gauge, 0.024 inch (0.61 mm).
   3. Profile: Standing seam, with minimum 1-inch (25 mm) seam height; concealed fastener system for field seaming with special tool.
   4. Texture: Smooth.
   5. Length: Full length of roof slope, without lapped horizontal joints.
   6. Width: Maximum panel coverage of 40 inches

2.04 METAL ROOF PANELS

A. Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels: Factory-formed panels with factory-applied finish.
   1. Aluminum Panels:
      a. Alloy and Temper: Aluminum complying with ASTM B209/B209M; temper as required for forming.
      b. Thickness: Minimum 20 gauge, 0.032 inch (0.81 mm).
   2. Profile: Standing seam, with minimum 1-1/2-inch (38 mm) seam height; concealed fastener system lapped seam in standing seam profile.
   3. Texture: Smooth.

4. Length: Full length of roof slope, without lapped horizontal joints.
5. Width: Maximum panel coverage of 36 inches (914 mm).

2.05 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.06 SECONDARY FRAMING

A. Miscellaneous Secondary Framing: Light gauge steel framing incidental to structural supports; fabricated from steel sheet.

B. Framing Material: ASTM A1011/A1011M Designation SS steel sheet.
1. Profile: Manufacturer's standard cee, zee, asymmetrical zee, hat channel, plain channel, single slope eave strut, double slope eave strut, and angle.
2. Thickness: 12 gauge, 0.1046 inch (2.657 mm).
3. Finish: Galvanized per ASTM A653/A653M, G90.

C. Framing Connectors: Factory-made formed steel sheet, ASTM A653/A653M SS Grade 50, with G60/Z180 hot dipped galvanized coating and factory punched holes.

2.07 FABRICATION

A. Panels: Provide factory or field fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

2.08 FINISHES

A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss as selected by Architect from manufacturer’s standard line.
1. Products:
a. Arkema, Inc; Kynar 500: www.arkema.com/#sle.
b. PPG; Duranar: www.ppgmetalcoatings.com/#sle.
c. Sherwin-Williams Company; Fluropon: www.coil.sherwin.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.

B. Siliconized Polyester Coating: Epoxy primer and silicone-modified polyester (SMP) enamel topcoat with minimum dry film thickness (DFT) of 0.8 mil (0.02 mm); color and gloss as indicated on drawings.

2.09 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: 1 inch (25.4 mm) high, narrow batten, close-fitting cap of steel with corrosion resistant finish, closed-cell synthetic rubber, neoprene, or PVC, combination steel and closed-cell foam, copper, or prefinished aluminum.

C. Sealants:
1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
3. Seam Sealant: Factory-applied, non-skinning, non-drying type.

D. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.

1. Type: Woven polypropylene with anti-slip polyolefin coating on both sides.
2. Self Sealability: Nail sealability in accordance with ASTM D1970/D1970M.
3. Flammability: Minimum of Class A, in accordance with ASTM E108 test method.
4. Low Temperature Flexibility: Comply with ASTM D1970/D1970M.
5. Water Vapor Permeance: 1 perm (57.2 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M, Desiccant Method A.
6. Performance: Comply with ASTM D226/D226M, Type II asphalt-saturated organic felt.
7. Liquid Water Transmission: Comply with ASTM D4869/D4869M.
8. Functional Temperature Range: Minus 70 degrees F (56.7 degrees C) to 240 degrees F (100 degrees C).
9. Fasteners: As specified by manufacturer and building code qualification report or approval.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Broom clean wood sheathing prior to installation of roofing system.

B. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to ensure that completed roof will be free of leaks.

C. Coordinate installation of waterproof membrane over roof sheathing with Section 061000.

D. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by metal roof panel manufacturer.

E. Protect surrounding areas and adjacent surfaces from damage during execution of this work.

F. At locations where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and metal roof panel manufacturer's instructions and recommendations, as applicable to specific project conditions; securely anchor components of roofing system in place allowing for thermal and structural movement.
   1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
   2. Minimize field cutting of panels. Where field cutting is required, use methods that will not distort panel profiles. Use of torches for field cutting is prohibited.

B. Accessories: Install necessary components that are required for complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. Roof Panels: Install metal roof panels in accordance with manufacturer's installation instructions, minimizing transverse joints except at junction with penetrations.
   1. Form weathertight standing seams incorporating concealed clips, using an automatic mechanical seaming device approved by panel manufacturer.
   2. Install sealant or sealant tape at end laps and side joints as recommended by metal roof panel manufacturer.

3.04 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION

SECTION 074213
METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal wall panel system.

1.02 RELATED REQUIREMENTS

A. Section 054000 - Cold-Formed Metal Framing: Wall panel substrate.

B. Section 061000 - Rough Carpentry: Wall panel substrate.

C. Section 072100 - Thermal Insulation.

D. Section 072500 - Weather Barriers: Weather barrier under wall panels.

E. Section 072600 - Vapor Retarders: Vapor retarder under wall panels.

F. Section 072700 - Air Barriers: Air barrier under wall panels.

G. Section 079200 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.

H. Section 092116 - Gypsum Board Assemblies: Wall panel substrate.

1.03 REFERENCE STANDARDS

A. AAMA 509 - Voluntary Test and Classification Method for Drained and Back Ventilated Rainscreen Wall Cladding Systems; 2022.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2026.

C. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2025a.

D. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

E. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

F. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
   1. Physical characteristics of components shown on shop drawings.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions and recommendations.

C. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.

D. Samples: Submit two samples of wall panel and soffit panel, 12 inches by 12 inches (305 mm by 305 mm) in size illustrating finish color, sheen, and texture.

E. Test Reports: Submit test report verifying compliance with NFPA 285 for previously-tested exterior wall assembly.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in installing products specified in this section with minimum three years of documented experience.

1.06 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Construct mock-up, 12 feet long by 5 feet wide; include panel and soffit system, glazing, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, and related insulation in mock-up.

C. Locate as directed by Architect.

D. Mock-up may remain as part of work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.

C. Prevent contact with materials that may cause discoloration or staining of products.

1.08 FIELD CONDITIONS

A. Do not install wall panels when air temperature or relative humidity are outside manufacturer's limits.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Finish Warranty: Provide 15-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Wall Panels - Exposed Fasteners:
   1. ATAS International, Inc; Corrugated Panel: www.atas.com/#sle.
   2. MBCI, a Cornerstone Building Brands Company: www.mbci.com/#sle.
   3. McElroy Metal: www.mcelroymetal.com/#sle.
   4. Taylor Metal Products; Classic 7/8 Corrugated: www.taylormetal.com/#sle.
   5. Best Buy Metals.
   6. Substitutions: See Section 016000 - Product Requirements.

2.02 METAL WALL PANEL SYSTEM

A. Description: Factory-fabricated, drained and back-ventilated (D/BV) rainscreen panel system, site assembled; comply with AAMA 509.

B. Performance Requirements:
   1. Design and size components to support assembly dead loads and withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
   2. Structural Performance:
      a. Comply with ASTM E330/E330M, using test pressure 1.5 times design wind pressure, with 10-second maximum load duration.
      b. Design Wind Loads: Comply with requirements of authorities having jurisdiction.

3. Water Penetration: No water penetration after 15 minutes when tested at minimum 6.27 psf (300 Pa) pressure differential in accordance with ASTM E331.
4. Movement:
    a. Accommodate movement within system without damage to components or seal deterioration.
    b. Accommodate movement between system and perimeter components when subject to seasonal temperature cycling, dynamic loading, load release, and support framing deflection.
5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

C. Exterior Wall Panels:
1. Profile: Vertical; style as indicated.
2. Side Seams: Double-interlocked, tight-fitting, sealed with continuous gaskets.
3. Material: Precoated steel sheet, 24 gauge, 0.0276 inch (0.70 mm) minimum thickness.
4. Color: As indicated on drawings.

D. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

E. Expansion Joints: Same material, thickness and finish as exterior sheets; gauge; manufacturer's standard brake formed type, of profile to suit system.

F. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

G. Anchors: Stainless steel.

2.03 MATERIALS

A. Precoated Steel Sheet: Aluminum-zinc alloy-coated steel sheet, ASTM A792/A792M, Commercial Steel (CS)) or Forming Steel (FS), with AZ50/AZM150 coating; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

B. Select materials with surface flatness, smoothness, and lack of surface blemishes where exposed to view in finished system.

C. Insulation: See Section 072100.

2.04 FINISHES

A. Exposed Surface Finish: Panel manufacturer's standard polyvinylidene fluoride (PVDF) coating, top coat over epoxy primer.

B. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss as selected by Architect from manufacturer’s standard line.
1. Products:
    a. Arkema, Inc; Kynar 500: www.arkema.com/#sle.
    b. PPG; Duranar: www.ppgmetalcoatings.com/#sle.
    c. Sherwin-Williams Company; Fluropon: www.coil.sherwin.com/#sle.
    d. Substitutions: See Section 016000 - Product Requirements.

2.05 ACCESSORIES

A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.

B. Concealed Sealants: Non-curing butyl sealant or tape sealant, see Section 079200

C. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.

D. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, stainless steel. Fastener cap same color as exterior panel.
   1. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws.

E. Field Touch-up Paint: As recommended by panel manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

3.02 PREPARATION

A. Protect surrounding areas and adjacent surfaces from damage during execution of this work.

3.03 INSTALLATION

A. Support for Cladding and Continuous Insulation: Install in accordance with Contractor-provided structural design; securely fasten; shim and level to uniform plane.

B. Install panels on walls in accordance with manufacturer's instructions.

C. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint; allow to dry prior to wall panel installation.

D. Fasten panels to structural supports; aligned, level, and plumb.

E. Locate joints over supports.

F. Lap panel ends 2 inches (51 mm), minimum.

G. Provide expansion and control joints where indicated.

H. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.04 TOLERANCES

A. Offset From True Alignment Between Adjacent Members Abutting or In Line: 1/16 inch (1.6 mm), maximum.

B. Variation from Plane or Location As Indicated on Drawings: 1/4 inch (6.4 mm), maximum.

3.05 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Remove site cuttings from finish surfaces.

C. Remove protective material from wall panel surfaces.

D. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

3.06 PROTECTION

A. Protect metal wall panels until completion of project.

B. Touch-up, repair, or replace damaged wall panels or accessories before Date of Substantial Completion.

END OF SECTION

SECTION 07 90 00

JOINT SEALERS

PART 1 GENERAL

1.01 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics.

C. Samples: Submit two samples, 1/4 x 2 inch in size illustrating sealant colors for selection.

1.02 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section with minimum two years experience.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silicone Sealants:
   1. Dow Corning Corp: www.dowcorning.com.
   2. GE Plastics: www.geplastics.com.
   3. Substitutions: Not permitted.

B. Polyurethane Sealants:
   1. Pecora Corporation: www.pecora.com.
   2. Sonneborn Building Products, ChemRex, Inc: www.chemrex.com.
   3. Tremco, Inc: www.tremcosealants.com.
   4. Substitutions: See Section 01600 - Product Requirements.

C. Butyl Sealants:
   1. Bostik: www.bostik.com.
   2. TEC Incorporated.
   3. Tremco, Inc: www.tremcosealants.com.
   4. Substitutions: See Section 01600 - Product Requirements.

D. Acrylic Emulsion Latex Sealants:
   1. Pecora Corporation: www.pecora.com.
   2. Sonneborn Building Products, ChemRex, Inc: www.chemrex.com.
   3. Tremco, Inc: www.tremcosealants.com.
   4. Substitutions: See Section 01600 - Product Requirements.

2.02 SEALANTS

A. Type E1 - General Purpose Exterior Sealant: Polyurethane; ASTM C 920, Grade NS, Class 25, Uses M, G, and A; multi- component.
   1. Color: To match adjacent surfaces.
   2. Applications:
      a. Control, expansion, and soft joints in masonry.
      b. Joints between concrete and other materials.
      c. Joints between metal frames and other materials.
      d. Other exterior joints for which no other sealant is indicated.

B. Type B1 - Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.

1. Applications:
    a. Concealed sealant bead in sheet metal work.
    b. Under thresholds.

C. Type A1 - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type OP, Grade NF single component, paintable.
    1. Color: Colors as selected.
    2. Applications:
        a. Interior wall and ceiling control joints.
        b. Joints between door and window frames and wall surfaces.
        c. Other interior joints for which no other type of sealant is indicated.

D. Type E2 - Bathtub/Tile Sealant: White silicone; ASTM C 920, Uses I, M and A; single component, mildew resistant.
    1. Applications:
        a. Joints between plumbing fixtures and floor and wall surfaces.

E. Type E3 - Bathtub/Tile Sealant: Clear silicone; ASTM C 920, Uses M and A; single component, mildew resistant.
    1. Applications:
        a. Joints between countertops and wall surfaces.

F. Type E4 - Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C 920, Class 25, Uses T, I, M and A; single component.
    1. Color: Color as selected.
    2. Applications:
        a. Joints in sidewalks and vehicular paving.

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

C. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter which might impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C 1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C 1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

D. Install bond breaker where joint backing is not used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

G. Tool joints concave.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION OF FINISHED WORK

A. Protect sealants until cured.

END OF SECTION

SECTION 08 12 00

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated steel doors and frames.

B. Steel frames for wood doors.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

1.03 REFERENCE STANDARDS

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

B. ANSI A250.3 - Test Procedure and Acceptance Criteria for Factory-Applied Finish Painted Steel Surfaces for Steel Doors and Frames; 2007 (R2011).

C. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; 2003.

D. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 1998 (R2011).

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

F. ASTM C1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2011.

G. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.

H. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2007.

I. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 1992.

J. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2006.

K. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2013.

L. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association; 2012.

M. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

N. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

D. Samples: Submit two samples of metal, 2 x 2 inches in size showing factory finishes, colors, and surface texture.

E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Maintain at the project site a copy of all reference standards dealing with installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames:

1. AssaAbloyCeco, Curries, or Fleming: www.assaabloydss.com.
2. Republic Doors: www.republicdoor.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS AND FRAMES

A. Requirements for All Doors and Frames:

1. Accessibility: Comply with ANSI/ICC A117.1.
2. Door Top Closures: Flush with top of faces and edges.
3. Door Edge Profile: Beveled on both edges.
4. Door Texture: Smooth faces.
5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
7. Galvanizing for Units in Wet Areas: All components hot-dipped zinc-iron alloy-coated (galvannealed), manufacturer's standard coating thickness.
8. Finish: Factory primed, for field finishing.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 STEEL FRAMES

A. General:

1. Comply with the requirements of grade specified for corresponding door, except:
    a. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 18 gauge
2. Finish: Same as for door.
3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
4. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
5. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.
6. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.

C. Exterior Door Frames: Fully welded.

1. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
2. Weatherstripping: Integral, recessed into door edge or frame.

D. Interior Door Frames, Non-Fire-Rated: Fully welded type.

E. Interior Door Frames, Fire-Rated: Fully welded type.

1. Fire Rating: Same as door, labeled.

2.04 ACCESSORY MATERIALS

A. Glazing: As specified in Section 08 8000.

B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

C. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

D. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.05 FINISH MATERIALS

A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.

B. Factory Finish: Complying with ANSI A 250.3, manufacturer's standard coating.

1. Color: To be selected by Architect from manufacturer's standard range.

C. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

B. Coat inside of other frames with bituminous coating to a thickness of 1/16 inch.

3.03 INSTALLATION

A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.

B. In addition, install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Coordinate installation of hardware.

E. Coordinate installation of glazing.

3.04 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 08 12 16
INTERIOR ALUMINUM DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pre-finished aluminum door frames for interior use.

B. Pre-finished aluminum window frames for interior use.

C. Pre-finished aluminum framing systems for interior use.

D. Pre-finished aluminum doors for interior use.

1.02 RELATED REQUIREMENTS

A. Division 08 Section "Glazing" for glass view panels in interior aluminum doors.

B. Division 08 Section "Aluminum Entrances and Storefront" for glazed aluminumdoors and framing used in exterior walls and vestibule enclosures.

C. Division 08 Section "Flush Wood Doors" for wood doors used in interior aluminum frames.

D. Division 08 Section "Door Hardware" for doorhardware used on interior aluminum doors and frames.

1.03 REFERENCE STANDARDS

A. AAMA 603.8 - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.

B. AAMA 607.1 - Guide Specification and Inspection Methods for Clear Anodized Finishes for Architectural Aluminum.

C. AAMA 608.1 - Guide Specification and Inspections Methods for Electrolytically Deposited Color Anodic Finished for Architectural Aluminum.

D. AAMA 609 & 610-02 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum.

E. ASTM B221 - Standard specification for aluminum and aluminum-alloy extruded bars, rods, wire, profiles, and tubes.

F. NAAMM - "Metal Finishes Manual for Architectural and Metal Products'.

1.04 SUBMITTALS

A. Submit under the provisions of Section 01 30 00.

B. Product Data: For each type of product indicated, include construction details, material descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

C. Templates: Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the interior aluminum door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

D. Shop Drawings: Include the following:

1. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
2. Locations of reinforcement and preparations for hardware.
3. Details of each different wall opening condition. Include requirements for steel framing at partitions for fit and securing of frames, partition widths and tolerances, direction of framing members, clips and attachments.
4. Details of anchorages, joints, field splices, and connections.
5. Details of accessories.
6. Details of moldings, removable stops, and glazing.
7. Elevations of each door design.

8. Details of doors, including vertical and horizontal edge details and metal thicknesses.
9. Details of preparations for power, signal, and control systems.

E. Samples for Verification: Provide at the request of architect, prepared Samples as indicated below:
1. Framing Member: 12 inches long.
2. Corner Fabrication: 12-by-12-inch-long, full-size window corner, including full-sizesections of extrusions with factory-applied color finish.
3. Aluminum chips in full range of manufacturer's standard finishes for architect's color selection.

F. Interior Aluminum Door and Frame Schedule: Use same designations indicated on Drawings. Coordinate with Door Hardware schedule and glazing.

G. Informational Submittals:
1. Certificates of Compliance: Submit any product test report or information necessary to indicate compliance with this specification section.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain interior aluminum frames and doors through one source from a single qualified manufacturer.

B. Aesthetic Effects: Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testingat positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL 10C.
1. Provide labels permanently fastened on each frame or door within size limits established by NFPA and the testing authority.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Label each individual glazed lite.

E. Smoke-Control Door Assemblies: Comply with NFPA 105.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver interior aluminum frames and doors individually protective wrapped within cartons and marked for the corresponding scheduled opening. Do not bulk pack frames.

B. Inspect frames upon delivery for damage.
1. Repair minor damage to pre-finished products as recommended by manufacturer.
2. Replace frames that cannot be satisfactorily repaired.

C. Store interior aluminum frames and doors at project site under cover and as near as possible to final installation location. Do not use covering material that will cause discoloration of aluminum finish.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of interior aluminum frame openings by field measurements before fabrication and indicate measurements on Shop Drawings submittals.

B. Do not install aluminum frames and doors until area of work has been completely enclosed and interior is protected from the elements.

C. Maintain temperature and humidity in areas of installation within reasonable limits, as close as possible to final occupancy standards. If necessary, provide artificial heating, cooling and ventilation to maintain required environmental conditions.

1.08 WARRANTY

A. Provide manufacturer's written warranty against defects in materials and workmanship upon final completion and acceptance of Work in this section.

1. Warrant framing and door finishes against defects and excessive fading and non-uniformity in color for a period of 5 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Frameworks Manufacturing.
2. RACO Interior Products, Inc.
3. Versatrac Frames, a Division of American Door Products Inc.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Extruded Aluminum: ASTM B 221 alloy 6063-T5 or alloy and temper required to suit structural and finish requirements.

2.03 INTERIOR ALUMINUM FRAMES

A. Provide interior aluminum framing components complying with dimensions, profiles, and relationships to adjoining work of components as indicated on Drawings. Provide frames that are adjustable for partition types and throat openings, or that are fitted to each partition type, meeting the throat opening and required clearances per frame manufacturer's recommendations. Reinforce for specified hinges, strikes, and closers.

1. Type-1 Framing System: Provide frames with the following characteristics:
    a. Rectilinear design.
    b. 1-1/2 inch face profile, 9/32 inch return.
    c. .070 inch rabbet wall thickness.
    d. Standard throat sizes (drywall partition thickness): 3-3/4", 4-7/8".
    e. Adjustable throat frames expandable from 3-5/8" up to 7-1/4”.
2. Type-2 Framing System: Provide frames with the following characteristics:
    a. Rectilinear design.
    b. 1-1/2 inch face profile.
    c. Snap on trim:
        1. 1-1/4 inch.
        2. 1-1/2 inch.
        3. 2 inch.
    d. .070 inch rabbet wall thickness.
    e. Standard throat sizes (drywall partition thickness): 3-1/2", 3-3/4", 4-5/8", 4-7/8", 5-1/4", 5-1/2", 6-1/8" and 7-1/4”.
    f. Adjustable throat frames expandable from 2-7/8" up to 8-3/8".

B. Glass Trim: Extruded aluminum, not less than 0.062 inch thick, designed for glass thickness indicated with removable snap-in casing trim, glazing stops, and door stops without exposed fasteners.

2.04 INTERIOR ALUMINUM DOORS

A. General: Provide 1-3/4 inch doors of type and design indicated, not less than 0.062 inch thick material.

B. Aluminum Stile & Rail Type Swinging Doors: Door stiles and rails to have tubular design with the following characteristics:

1. Stiles:
    a. Narrow Stile (2-1/8").
    b. Medium Stile (3-3/4").
    c. Wide Stile (5”).
2. Rails:
    a. 1-1/2" Top Rail.
    b. 3-3/4" Top/Bottom Rail.
    c. 6" Top/Bottom Rail.
    d. 9-1/2" Bottom Rail.
3. Snap-in stops with factory applied glazing gaskets for 1/4", 3/8", or 1/2" thick glass.

C. Aluminum Stile & Rail Sliding Type Doors: Subject to the same tubular design standardsas Stile & Rail Type Swinging Doors with the following characteristics:

1. Sliding door track to be installed in properly blocked ceiling or wall above frame, or to header clip (by manufacturer) attached to the frame header. Sliding track to be provided with snap on covers.
2. Sliding Door Hardware:
    a. Tricycle Rollers: 2 each per panel. Maximum 1 each roller per 75 lbs.
    b. Provide bumper stops in track assemblies.
    c. Provide concealed door guide at floor (track assemblies not allowed).

2.05 ACCESSORIES

A. Fasteners: Aluminum, nonmagnetic, stainless-steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.

B. Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals.

C. Glazing Gaskets: Manufacturer's standard extruded or molded plastic, to accommodate glazing thickness indicated.

D. Glazing: Comply with requirements in Division 08 Section, "Glazing”.

E. Hardware: As specified in Division 08 Section, "Door Hardware".

2.06 FABRICATION

A. Factory pre-engineer and pre-cut interior aluminum frame components to the greatest extent practical. Linear glazing components fabricated in the field are not allowed. Allow for 2 inches excess vertical length for scribing to suit floor conditions. Machine jambs and prepare for hardware, with concealed plates, drilled and tapped as required, fastened in frame with concealed screws.

B. Provide concealed corner reinforcements and alignment clips for precise joints at butt or mitered connections.

C. Hardware Preparation: Factory interior aluminum frames and doors to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates as specified in Division 08 Section, "Door Hardware”.

1. Reinforce doors and frames to receive surface mounted door hardware. Machine jambs and prepare for hardware, with concealed reinforcement

plates, drilled and tapped as required and fastened within frame with concealed screws.

2. Locate hardware as indicated.
3. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

D. Clearances for Non-Fire-Rated Door Frames: Not more than 1/8 inch at jambs and heads, not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.

E. Fabricate frames for glazing with removable stops to allow glazing replacement without dismantling frame.

F. Fabricate all components to allow secure installation without exposed fasteners.

2.08 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products' for recommendations for apply and designated finishes. Exposed surfaces to be free of scratches and other serious blemishes.

B. Factory finish extruded frame components so that any part exposed to view upon completion of installation will be uniform in finish and color.

C. Polyester Finish: Comply with AAMA 603.8; multiple-stage electrostatically applied thermoset polyester finish, baked to assure hardness.

1. Color: Custom paint color to match architect sample.
2. Color: Manufacturer's standard bronze.
3. Color: Manufacturer's standard gray.
4. Color: Manufacturer's standard black.
5. Color: Manufacturer's standard white.

D. Clear anodic coating: Comply with AAMA 607.1.

1. Class 2, AAM12C22A31 clear anodized coating, 0.4-.07 mill thickness minimum.
2. Class 1, AAM12C22A41 clear anodized coating, 0.7 mill thickness minimum.

E. Color anodic coating: Comply with AAMA 608.1.

1. Class 2, AAM12C22A34 color coating electrolytically deposited, 0.4-0.7 mill thickness minimum.
2. Class 2, AAM12C22A44 color coating electrolytically deposited, 0.4-0.7 mill thickness minimum.
3. Color: Bronze anodized.
4. Color: Black anodized.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify wall thickness does not exceed standard tolerances allowed by specified frame throat sizes.

C. General Contractor to verify the accuracy of dimensions given to frame and door manufacturer for pre-cut openings.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install and set interior aluminum frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

1. At fire-protection-rated openings, install frames according to NFPA 80.

B. Install frame components in the longest possible lengths with no component less than 48 inches.

1. Fasten to suspended ceiling grid at 48 inches on center maximum, using #6 sheetmetal screws or other fasteners approved by frame manufacturer.
2. Use concealed installation clips to produce tightly fitted and aligned splices andconnections.
3. Secure clips to extruded main-frame components and not to snap-in or trim members.
4. Do not use screws or other fasteners exposed to view when installation is complete.

3.03 ADJUSTING & CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before finalinspection. Leave work in complete and proper operating condition.

B. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended by frame manufacturer and according to AMMA 609 & 610.

C. Touch up marred areas so that touch up is not visible from a distance of 48 inches. Remove and replace frames that cannot be satisfactorily repaired.

3.04 PROTECTION

A. Provide protection as required to assure that frames will be without damage or deterioration upon substantial completion of the project.

END OF SECTION

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush configuration; rated and non-rated.

B. Hollow metal frames.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

1.03 QUALITY ASSURANCE

1.04 DELIVERY, STORAGE, AND PROTECTION

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.05 PROJECT CONDITIONS

A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide warranty for the following term:

1. Interior Doors: Life of installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, telegraphing core construction, and/or do not conform to tolerance limitations of referenced quality standards.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Proprietary Product:

1. Algoma Hardwoods, Inc.
2. Marshfield Door Systems, Inc.

2.02 DOORS

A. All Doors: See drawings for locations and additional requirements.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.

1. Provide solid core doors at all locations.

2.03 DOOR AND PANEL CORES

A. Non-Rated, 20 minute and 45 minute Solid Core: Type PC, particleboard core, plies and faces as indicated.

B. Face Veneer shall be standard thickness, thoroughly dried, tapeless, complying with listed AWI standards, laid at right angles to cross banding.

C. Hollow Core Doors: Type SHC - Standard; plies and faces as indicated above.

2.04 DOOR FACING

A. Interior Doors - Veneer: Custom grade wood veneer, species shall be premium grade, plain sliced red oak.

2.05 ACCESSORIES

A. Glazing Stops:

1. Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws for 20 min., 45 min. and non-rated doors.
2. Metal as required for 1 HR rated doors.

2.06 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Fit door edge trim to edge of stiles after applying veneer facing.

C. Provide edge clearances in accordance with AWI Quality Standards Illustrated Section 1700.

2.07 HOLLOW METAL FRAMES

A. Construction:

1. Combination type with integral trim and fabricated with mitered and full welded face type construct at corners.
2. Metal shall be phosphate-treated prior to painting.
3. Shall be fabricated from steel not lighter than 16 gauge.

B. Provide metal anchors of shapes and sizes required for the adjoining type of wall construction.

C. Fabricate jamb anchors of steel, not lighter than 16 gauge. Locate anchors on jambs near the top and bottom of each frame and at intermediate points not over 24” apart.

D. Weld jamb anchor clips to back of frames at jambs. Make provisions for screwing anchors to steel studs with ¼ round-head self-tapping screws, or by welding.

E. Provide floor clips of not less than 16-gauge steel and fasten to bottom of each jamb member for anchoring frame to floor construction. Clips shall be fixed and drilled for 3/8” diameter anchor bolts.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Trim door height by cutting bottom edges to a maximum of 3/4 inch (19 mm).

C. Coordinate installation of doors with installation of frames and hardware.

D. Coordinate installation of glazing.

E. All holes, cutting etc. to be shop machined. No field modifications allowed.

3.03 INSTALLATION TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for maximum diagonal distortion.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE - SEE DRAWINGS

END OF SECTION

SECTION 08 41 13

ALUMINUM FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Architectural Aluminum Storefront Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.

B. Related Sections:

1. 07 92 00 “Joint Sealants”
2. 084413 “Glazed Aluminum Curtain Walls”
3. 085113 “Aluminum Windows”
4. 088000 “Glazing”

1.02 PERFORMANCE REQUIREMENTS

A. Storefront Performance Requirements:

1. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft^2 (0.3 l/s · m^2) at a static air pressure differential of 6.24 psf (300 Pa).
2. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 8 psf (383 Pa) as defined in AAMA 501.
3. Uniform Load: A static air design load of 20 psf (958 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of aluminum-framed storefront system indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type, of aluminum-framed storefront.

D. Other Action Submittals:

1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of providing aluminum-framed storefront system that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

C. Source Limitations: Obtain aluminum-framed storefront system through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum-framed storefront system and are based on the specific system indicated. Refer to Division 01 Section “Product Requirements”. Do not modify size and dimensional requirements.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of aluminum-framed storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.06 WARRANTY

A. Manufacturer’s Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty.
   1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product:
   1. Kawneer Company Inc.
   2. Trifab® VersaGlaze® 451T
   3. Glass: Center Plane.

B. Substitutions:
   1. Refer to Substitutions Section for procedures and submission requirements.

2.02 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8 mm) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.

B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum framing members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

F. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

2.03 STOREFRONT FRAMING SYSTEM

A. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposes shall be stainless steel.

C. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

D. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

E. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

2.04 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section “Glazing”.

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:

1. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.

2.05 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: As specified in Division 084113 Section “Aluminum-Framed Entrances and Storefronts”.

B. Entrance Door Hardware: As specified in Division 084113 Section “Door Hardware”.

2.06 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section “Joint Sealants”.

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil (0.762 mm) thickness per coat.

2.07 FABRICATION

A. Extrude aluminum shapes before finishing.

B. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fit joints; make joints flush, hairline and weatherproof.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

D. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

E. Storefront Framing: Fabricate components for assembly using manufacturer’s standard installation instructions.

F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.08 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   1. Kawneer Permanodic™ AA-M10C21A44 / AA-M45C22A44, AAMA 611, Architectural Class I Color Anodic Coating (Color _____).
   2. Kawneer Permanodic™ AA-M10C21A41 / AA-M45C22A41, AAMA 611, Architectural Class I Clear Anodic Coating (Color #14 Clear) (Optional).
   3. Kawneer Permanodic™ AA-M10C21A31, AAMA 611, Architectural Class II Clear Anodic Coating (Color #17 Clear) (Standard).
   4. Kawneer Permafluor™ (70% PVDF), AAMA 2605, Fluoropolymer Coating (Color _____).
   5. Kawneer Permadize™ (50% PVDF), AAMA 2604, Fluoropolymer Coating (Color _____).
   6. Kawneer Permacoat™ AAMA 2604, Powder Coating (Color _____)

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight aluminum- framed storefront installation.
   1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
   2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
   3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
   4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed storefront system, accessories, and other components.

B. Install aluminum-framed storefront system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

D. Install aluminum-framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within aluminum-framed storefront system to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.03 FIELD QUALITY CONTROL

A. Field Tests: Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.

1. Testing: Testing shall be performed by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements. Testing Standard per AAMA 503, including reference to ASTM E 783 for Air Infiltration Test and ASTM E 1105 Water Infiltration Test.

    a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft^2, whichever is greater.

    b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.24 psf (300 Pa).

B. Manufacturer's Field Services: Upon Owner’s written request, provide periodic site visit by manufacturer’s field service representative.

3.04 ADJUSTING, CLEANING & PROTECTION

A. Clean aluminum surfaces immediately after installing aluminum-framed storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 08 51 13

EXTERIOR ALUMINUM WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fixed and operable aluminum-framed windows for exterior locations.

1.02 RELATED REQUIREMENTS

A. Division 08 Section "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units.

B. Division 08 Section "Glass and Glazing" for glazing requirements for aluminum windows, including those specified to be factory glazed units.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide aluminum windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:

1. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
    a. Basic Wind Speed: 90 mph.
    b. Importance Factor: I.
    c. Exposure Category: B.
2. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on testing performed according to AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Deflection Test or structural computations.

B. Windborne-Debris Resistance: Provide glazed windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 or AAMA 506 and requirements of authorities having jurisdiction.

C. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

D. Conformance to AP-HC65 specifications in AAMA/NWWDA 101/I.S.2-97 when tests are performed on a 5'0" x 2'8" minimum frame size with the following test results:

1. Air Infiltration: maximum .13 cfm/square foot when tested per ASTM E 283-99 at a static air pressure difference of 6.24 psf.
2. Water Penetration: no uncontrolled water leakage when tested per ASTM E 547-00 and ASTM E 331-00 at a static air pressure difference of 10 psf.
3. Uniform Structural: window to be operable, and maximum .4% permanent deformation per member when tested per ASTM E 330-97 at a static air pressure difference of 97.5 psf.

E. Thermal testing per AAMA 1503-98, at the prescribed 4'0" x 6'0" test size glazed with 1” insulating glass made with 1/8” clear and 1/8” hard coat low E lites and argon gas, with the following test results:

1. Condensation Resistance Factor: minimum 61 frame and 65 glass CRF.
2. Thermal Transmittance: maximum .47 BTU/HR/SQ.FT/F U value.

1.04 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:

C. Samples for Initial Selection: For units with factory-applied color finishes.

1. Include similar Samples of hardware and accessories involving color selection.

D. Samples for Verification: For aluminum windows and components required, prepared on Samples of size indicated below upon Architect's request.

1. Main Framing Member: 12-inch- long, full-size sections of extrusions with factory-applied color finish.
2. Window Corner Fabrication: 12-by-12-inch- long, full-size window corner including full-size sections of extrusions with factory-applied color finish, weather stripping, and glazing.
3. Operable Window: Full-size unit with factory-applied finish.
4. Hardware: Full-size units with factory-applied finishes.
5. Weather Stripping: 12-inch- long sections.

E. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

F. Qualification Data: For Installer, manufacturer, and professional engineer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by an AAMA Certified testing agency for each type, class, grade, and size of aluminum window. Test results based on use of downsized test units will not be accepted.

H. Maintenance Data: For operable window sash operating hardware and finishes to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Do not modify size and dimensional requirements.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that have failed in materials or workmanship within specified warranty period.

B. Warranty Period:

1. Window: Two years from date of Substantial Completion.
2. Glazing: Five years from date of Substantial Completion.
3. Metal Finish: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. EFCO Corporation.
2. Graham Architectural Products Corp.
3. Kawneer; an Alcoa Company.
4. TRACO.
5. Winco Window Company.
6. Capitol Aluminum & Glass.
7. Wausau.
8. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength, not less than 16,000-psi minimum yield strength, and not less than 0.125-inch thickness at any location for the main frame and sash members.

B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

D. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2/NAFS.

E. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.03 WINDOWS

A. AAMA Designation: AP-AW65.

B. Windows: 4-1/2" frame depth; extruded aluminum with integral structural polyurethane thermal break; vent flush with frame; equal-leg frame; finish factory-applied; factory-assembled.

C. Configuration: Fixed per frame.

D. Triple glazing: exterior tape; 1" insulating glass; internal EPDM gasket; maximum 1/4" interior lite in flexible PVC gasket in butt-hinged panel secured with aluminum swivel clips opened with a star pin wrench; factory-glazed.

E. Fixed glazing: exterior tape; 1" insulating glass; EPDM gasket; interior aluminum glazing bead; factory-glazed.

2.04 GLAZING

A. Glass: Clear, insulating-glass units, with a high performance low-E coating on third surface with a Solar Heat Gain Coefficient (SHGC) of 0.40.

1. Exterior glass lite:
    a. Thickness: 1/8”.
    b. Tint: Clear.
    c. Type: Tempered.
2. ¾” Airspace.
3. Interior Glass lite:
    a. Thickness: 1/8.

b. Tint: Clear.

c. Type: Tempered.

2.05 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows, and sized to accommodate sash or ventilator weight and dimensions.

B. Hardware: concealed stainless steel hinges conforming to AAMA 904-01 to rotate vent outward on horizontal axis; white bronze strike and cam.

C. Sill Cap/Track: Extruded-aluminum track with finish to match frame, of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.

D. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.

E. Push-Bar Operators: Provide telescoping-type, push-bar operator designed to open and close ventilators with fixed screens

F. Limit Devices: Provide limit devices designed to restrict sash or ventilator opening.

1. Safety Devices: Limit clear opening to 6 inches for ventilation; with custodial key release.

2.06 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Fabricate aluminum windows that are re-glazable without dismantling sash or ventilator framing.

C. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.

D. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.

E. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior. Non-weeped systems are not acceptable.

F. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

G. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS. Cap beading is not acceptable.

H. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

2.07 GENERAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.08 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class II, Standard Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular at fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coming 0.010 mm or thicker) complying with AAMA 61.

1. Color: Clear Anodized.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

3.02 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior. Install sill into a sealed tank sub-sill. The use of a two piece receptor is not acceptable.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.03 ADJUSTING, CLEANING & PROTECTION

A. Adjust operating sashes and ventilators, screens, hardware, operators, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

E. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION

SECTION 085200
WOOD WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory-fabricated wood windows.

B. Glazing.

C. Insect screens.

D. Wood trim for exterior finishing.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Rough opening framing.

B. Section 072500 - Weather Barriers: Sealing frames to water-resistive barrier installed on adjacent construction.

C. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.

D. Section 087100 - Door Hardware.

E. Section 088000 - Glazing.

F. Section 099123 - Interior Painting: Site finishing wood surfaces.

G. Section 099300 - Staining and Transparent Finishing: Site finishing wood surfaces.

1.03 REFERENCE STANDARDS

A. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products; 2021.

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2022, with Errata (2023).

B. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).

C. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Show component dimensions, anchorage and fasteners, glass, internal drainage details.

C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, installation requirements.

D. Samples: Two samples 6 by 6 inch in size illustrating window frame section.

E. Operating Hardware: Two samples of each type of operating hardware.

F. Manufacturer's Certificate: Certify that products furnished meet or exceed specified requirements.

G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

H. Manufacturer's qualification statement.

I. Installer's qualification statement.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect factory finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).

B. Maintain this minimum temperature during and after installation of sealants.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Aluminum Clad Wood Windows:
   1. Andersen Windows, Inc; E-Series Casement Windows: www.andersenwindows.com/#sle.
   2. Marvin; Signature Ultimate Clad Wood Windows: www.marvin.com/#sle.
   3. Pella Corporation; Pella Lifestyle Series: www.pellacommercial.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 WOOD WINDOWS

A. Wood Windows: Wood frame and sash, factory fabricated and assembled.
   1. Exterior Finish: Metal clad, anodized.
   2. Interior Finish: Unfinished, for transparent finish.
   3. Configuration: As indicated on drawings.
   4. Metal Cladding: Formed aluminum, factory finished, factory fit to profile of wood members.
   5. Transparent Finish: Scarf joints permitted if wood matches in color and grain texture.

2.03 COMPONENTS

A. Glazing: Double glazed, clear, Low-E coated, argon filled, with glass thicknesses as recommended by manufacturer for specified wind conditions.

B. Glass and Glazing Materials: See Section 088000.

C. Frames: 2 inch wide by 2 inch deep profile; flush solid wood glass stops of screw fastened type, sloped for positive drainage.

D. Mullions: 2 inch wide by 2 inch deep profile.

E. Sills: Extruded aluminum, with 2 inch 2 nominal thickness; sloped for positive drainage; fits under sash and projects at least 1/2 inch (12 mm) beyond exterior face of wall; single piece full width of opening.

F. Insect Screens: Extruded aluminum frame with mitered and reinforced corners; screen mesh taut and secure to frame; secured to window with adjustable supports allowing screen removal without use of tools.
   1. Supports: Spring-loaded steel pins; four per screen unit.
   2. Screen Mesh: Vinyl-coated fiberglass, window manufacturer's standard mesh.
   3. Frame Finish: Baked enamel, color to match window interior color.

G. Operable Sash Weatherstripping: Wool pile; permanently resilient, profiled to effect weather seal.

H. Fasteners: Stainless steel.

I. Sealant and Backing Materials: See Section 079200 of types as indicated.

J. Wood for Casings and Trim: Clear cedar, clear preservative treated, of type suitable for required finish.

K. Flashing: Provide related flashings, with necessary anchors and attachment devices.

L. Sealant for Setting Sills, Stools, Aprons, and Sill Flashing: Non-curing butyl type.

2.04 PERFORMANCE REQUIREMENTS

A. Comply with AAMA/WDMA/CSA 101/I.S.2/A440 requirements for the specific window type in accordance with the following:
   1. Performance Class (PC): CW.

B. Design Pressure (DP): In accordance with applicable codes.

C. Overall Thermal Transmittance (U-value): 0.35, maximum, including glazing, measured on window sizes required for this project.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings and adjoining water-resistive barrier materials are ready to receive wood windows; see Section 072500.

3.02 INSTALLATION

A. Install windows in accordance with manufacturer's instructions.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

D. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

E. Install operating hardware.

F. Install glass and infill panels; see Section 088000.

G. Finish interior surfaces with transparent materials; see Section 099300.

3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: 1/16 inch per 3 ft (1.6 mm per m) non-cumulative or 1/8 inch per 10 ft (3.2 mm per 3 m), whichever is less.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

B. Provide field testing of installed wood windows by independent laboratory in accordance with AAMA 502 and AAMA/WDMA/CSA 101/I.S.2/A440 during construction process and before installation of interior finishes.
   1. Field test for water penetration in accordance with ASTM E1105 using Procedure B - cyclic static air pressure difference; test pressure shall not be less than 1.9 psf (91 Pa).
   2. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 6.27 psf (300 Pa).

C. Repair or replace fenestration components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.06 CLEANING

A. Remove protective material from factory finished surfaces.

B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

END OF SECTION

New Operators Building for Catawba County Landfill

SECTION 08710 - FINISH HARDWARE

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. Acceptable Designs: Specified products and their manufacturers establish acceptable design, material, type, grade, size, function, and finish of hardware items required. Do not substitute other products, except with Architect's and Owner's acceptance.

B. Manufacturer: Obtain each kind of hardware as Scheduled below, although several may be indicated as offering products complying with the manufacturer's requirements.

C. Supplier: The hardware supplier shall be a full member of the Society of Architectural Hardware Consultants and shall be available during normal working hours during the course of the project for hardware consultation to the Owner, Architect, and Contractor.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with the requirements of Section 01300. Include installation and maintenance instructions for operating parts and finish. Transmit copy of applicable data to Installer.

B. Certificates: Any hardware that is furnished other than that scheduled on the drawings shall have manufacturer's certificates certifying that the hardware meets this specification submitting the hardware shop drawings.

C. Hardware Schedule: Submit final hardware schedule in the manner and format indicated below. Hardware schedules are intended for coordination of work.

1. Organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening, including:

    a. Type, style, function, size and finish of each hardware item.
    b. Name and manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of hard set cross-referenced to indications on Drawings both of floor plans and in door and frame schedule.
    e. Explanation of all abbreviations, symbols, code, etc. contained in schedule.
    f. Mounting locations for hardware.
    g. Door and frame sizes and materials.

2. Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work [e.g. hollow metal frames], which is critical in the project construction schedule.
3. Include product data, samples, shop drawings of other work affected by builder's hardware, and other information essential to the coordinated review of hardware schedule.
4. Templates: Furnish for the installation of all hardware and to the manufacturer of related equipment for his preparation of that equipment for all hardware that must be attached thereto. Templates shall also be furnished to the manufacturer of wood doors for use on all wood doors that are factory fitting and factory machined for hardware.

D. Keying Schedule: To be coordinated with Owner's Representative and the Best KSS (key system Specialist). Locks will be provided with Construction Cores and Permanent Cores will be provided to the owner for change out after completion.

E. Samples: Prior to submittal of the final hardware schedule and prior to final ordering of builders hardware, submit one sample of each type of exposed hardware unit, finished as required, and tagged with full description for coordination with schedule.

1.3 JOB CONDITIONS:

A. Coordinate hardware with other work. Tag each item or package separately with identification related to the final hardware schedule. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security, and similar requirements indicated as necessary for proper installation and function. Deliver individually packaged hardware items at the proper times to the proper location [shop or project site] for installation.

B. Packing and Marking: Package each item of hardware separately in individual containers, complete with necessary screws, keys, instructions and installation templates for spotting mortising tools. Mark each container with item's number corresponding to number shown on hardware supplier's schedule and properly tag each cylinder's key.

C. Provide secure lock-up for hardware delivered to the project but not the installed. Control the handling and installation of hardware items, which are not immediately replaceable, so that the completion of the work will not be delayed by hardware losses, both before and after installation.

D. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check the shop drawings of such other work to confirm that adequate provisions are made for the proper installation of hardware.

E. Inspection of Hardware and Installation: The hardware supplier shall visit the project when the hardware is delivered and check it before it is installed. He shall visit the project again after all the hardware has been installed and shall notify the Architect if there is any hardware that has not been installed correctly. Contractor and supplier shall furnish Architect with written certification to this effect. After the hardware is installed, the hardware supplier shall meet with the Owner or his representative and explain the functions, uses, and maintenance of all types of hardware installed. The Contractor shall turn over to the owner, after completion of the work, all tools, wrenches and templates that come packaged with the hardware for the Owner's use in servicing the hardware. The hardware supplier shall adjust the door closers for proper operation with particular attention being given to final operation of the air conditioning, heating and ventilating system.

PART 2 - PRODUCTS

2.1 PRODUCTS:

A. Acceptable Manufacturers:

1. Hinges: Best
2. Continuous Gear Hinges: National Guard Products
3. Cylinders: Best
4. Door Closers: Best
5. Locks, Latches: Best
6. Silencers, Stops; ABH
7. Kick Plates, & Misc.: ABH
8. Weatherstrip: National Guard
9. Push/Pulls: ABH
10. Exit Devices: Precision
11. Thresholds: National Guard
12. Overhead Stops/Holders: ABH

13. Electronics: NA
14. Auto Operators: NA

2.2 MATERIALS, FABRICATION AND FINISHES:

A. General:

1. Manufacturer's Name Plate: Do not use products which have manufacturer's name or trade name displayed in a visible location except in conjunction with required UL labels.
2. Unless otherwise noted, exposed hardware items shall receive satin stainless steel finish.
3. Furnish screws of type as required for substrates indicated with each hardware item. Finish exposed screws to match the hardware finish or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible.
4. Unless otherwise noted, provide concealed fasteners for hardware units that are exposed when door is closed. Where fasteners must remain exposed when door is closed. Where fasteners must remain exposed, provide vandal resistant fasteners.
5. Finish shall be as scheduled. Dull Chrome [US26D], Dull Stainless Steel [US32D] Aluminum Lacquer [AL], Extruded Aluminum [Alum] and Prime Coat [USP] as listed.
6. Tools for maintenance: Furnish a complete set of specialized tools as needed for Owner's continued adjustment, maintenance and removal and replacement of builder’s hardware.
7. Hardware Operation: Force required to activate door hardware shall be not greater than 5 lbf.
8. Door Opening Force: Maximum force for pushing or pulling open a door shall comply with this paragraph. For hinged doors the force shall be applied perpendicular to the door at the door opener or 30 inches from the hinged side whichever is farther from the hinge.

    a. Exterior hinged doors shall not exceed 8.5 lbf. Slight increases in opening force shall be allowed where 8.5 lbf. is insufficient to compensate for air pressure differentials.
    b. Interior hinged doors shall not exceed 5.0 lbf.
    c. Fire doors shall be adjusted to meet the minimum opening force permitted by governing fire safety standards.

B. Hinges:

1. Provide template-produced hinges complying with ANSI A156.1.
2. Provide stainless steel pins, non-removable type for exterior doors and non-rising types for interior doors. Pins shall have flat button ends finished to match hinge leaves.
3. Hinges shall be full-mortised, 4½” x 4½” unless otherwise noted; five knuckle ball bearing type, heavy duty rated.

C. Keys and Keying:

1. Provide construction cores and keys during the construction period. Construction, control and operating keys and cores shall not be part of the Owner’s permanent keying system or furnished on the same keyway as the Owner’s permanent keying system. Permanent cores and keys prepared according to the accepted keying schedule will be delivered to the Owner by the local factory representative prior to occupancy. The Owner or Owner’s agent will install permanent cores.
2. All cylinders shall be BEST, interchangeable core and keyed to an existing registered Grand Master Key System with a restricted keyway.
3. Permanent keys and cores shall be stamped with the applicable key mark for identification. These visual key control marks or codes will *not* include the actual key cuts. Permanent keys will also be stamped “Do Not Duplicate”.
4. Grand Masterkeys, Masterkeys and other Security Keys shall be transmitted to the Owner U.P.S. delivery confirmation request.
5. Furnish keys in the following quantities:

2 each Grand Masterkey
2 each Masterkeys per set
3 each Change Key per each keyed core
6 each Construction masterkeys
2 each Control Keys
AS INSTRUCTED BY THE OWNER:

D. Locksets and Latchsets:

1. Base Specification: Best Dormakaba components as listed.
2. Locksets and latchsets of other acceptable manufacturers must conform to the requirements of Subparagraphs 3 and 4.
3. Mortise Type:

   a. Locksets and latchsets shall be heavy duty mortise type with hinged, anti-friction, ¾ inch throw latchbolt with anti-friction piece made of self-lubricated stainless steel. Functions and design as indicated in the hardware groups. Deadbolt functions shall be one-inch projection stainless steel construction. Both deadbolt and latchbolt to extend into lock case a minimum of 3/8 inch when fully extended.
   b. Levers to be Sparta design.
   c. Furnish locksets and latchsets with sufficient strike lip to protect door trim.
   d. Provide locksets with Best Schlage IC cylinders. All mortise cylinders shall have a concealed internal set screw for securing the cylinder to the lockset. The internal set screw will be accessible only by removing the core from the cylinder body.
   e. All mortise locksets and latchsets must conform to ANSI A156.13, Series 1000, Operational Grade 1 and be listed by UL.
   f. Locksets must fit ANSI A115.1 door preparation.
   g. Locksets and latchsets to have self-aligning through-bolted trim.
   h. Auxiliary deadlatch to be made of one-piece stainless steel, permanently lubricated.
   i. Locksets must be available with tactile or knurled knobs or levers for identification of hazardous areas.
   j. Lever handles must be of forged or cast brass, bronze or stainless steel construction and conform to ANSI A117.1. Levers, which contain a hollow cavity, are not acceptable.

4. Cylindrical Type

   a. Locksets must be extra heavy-duty cylindrical type with 2 ¾ inch backset, or greater as specified, with a 9/16 inch throw latchbolt.
   b. Provide locksets with Schlage Patented interchangeable core.
   c. Locksets and latchsets must conform to ANSI A156.2, Series 4000, Grade 1 and be UL listed.
   d. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty.
   e. Locksets must be available with tactile lever for identification of hazardous areas.
   f. Locks to have solid shank with no opening for access to keyed lever keeper.
   g. Keyed lever to be removable only after core is removed, by authorized control key, to allow access to lever “keeper”.
   h. Permanent cores face must be the same finish as the lockset finish. Levers must be zinc material with a minimum wall thickness of .060.

E. Exit Devices: Exit devices shall be as scheduled with no substitutes accepted. Exit devices shall comply with ANSI Standard 156.3 Grade 1 modified as follows:

1. The devices shall be “touchpad” type and include sound reduction dampening for both depression and extension of the touchpad. The touchpad shall extend a minimum of 1/2 of the door width.

2. Devices should have a ¼" gap between the face of the door and the touchbar unit eliminating the need for shims or cutting away the glass moulding.
3. Lock stile chassis shall be investment cast steel. Stamped steel units will not be accepted. All device latchbolts shall be stainless steel and shall be deadlocking type.
4. Device strikes shall be investment cast stainless steel.
5. Device end cap shall be all metal and secured with bracket that completely inserts into device housing. Mounting bracket shall interlock both at the touchbar channel and hinge side filler to prevent end cap "peel-back".
6. All outside device trim shall be cast or forged brass full escutcheon. Lever trim shall be "vandal resistant" with substantial resistance to rotation when locked. Lever shall return to home position when released. If required.
7. Device housing and all exposed surfaces of the device shall be manufactured from Brass, Bronze or Stainless Steel.
8. Devices must be non-handed and convertible from one function to another in the field. .
9. Device shall be secured to the door with sex bolts and through bolting at both ends.
10. All devices shall be UL approved for all types and functions indicated in the Hardware Schedule.
11. Devices shall have published five-year warranty.
12. All exit devices shall be by the same manufacturer.
13. Mullions shall be "keyed removable" type with only a key required for take down. No key or tools shall be required to reinstall. Mullions shall be by the same manufacturer as the exit devices.

F. Closers: Shall be as scheduled with no substitutes accepted. Closers shall comply with ANSI Standard A156.4 Grade 1 modified as follows:

1. Closer shall be non-handed and have adjustable spring power range from size 1 to 6 plus 50% (ANSI PT-4C). Front facing adjustable spring with Allen Wrench.
2. Closer shall have R14 high silicone aluminum alloy cylinder body with 1 ½" diameter steel piston.
3. Closer shall have 3 hydraulic adjustments to control backcheck, closing and latching speeds. Adjustment shall be by means of non-critical "v-slot" regulating valves. Closer shall not incorporate pressure relief valves on the opening or closing cycle. All front facing.
4. Closer shall have hydraulic fluid with a consistent viscosity range of no less than 0 to 100 degrees Fahrenheit to eliminate seasonal adjustment.
5. Closer shall be U.L. Listed and meet positive pressure testing requirements of UL10C and UBC 7-2.
6. Closers shall have forged main arms. Parallel mounted closers shall have Extra Duty (EDA) arm incorporating forged main and forearms, and a cast mounting shoe.
7. Closer shall have ten-year warranty.

G. Overhead Stops/Holders: Shall be as scheduled.

1. Units shall have metal/plated end plugs.
2. Units mounting screws shall be designed so that they go through housing and end plug.
3. Units shall have metal slide.
4. All stops shall be by same manufacturer.

H. Silencers, Stops & Flush Bolts: Shall be as scheduled.

1. Silencers: Provide plug-type [not adhered type] silencers in all metal door frames unless continuous bumper-type weather-stripping is shown or specified. Provide 3 silencer units in door frames.
2. All Stops [wall and floor] shall be by the same manufacturer.
3. Flush bolts shall have 3/4" throw with 2" vertical adjustment. Shall have override feature and stainless steel cams and rubplates. All flush bolts shall be by the same manufacturer.

I. Door Stripping and Seals: Unless otherwise indicated, provide full-length weather-stripping at each edge of every exterior swing door leaf. All weather-stripping to be by same manufacturer.

J. Thresholds: Extruded aluminum, smooth commercial mill finish, grooved tread, 4" minimum tread by full door width. Thickness of threshold shall be 0.5" at primary tread surfaces, 0.1875" for secondary tread surfaces, and 0.125" for concealed flanges and legs.

K. Kick Plates, Mop Plates and Armor Plates: .050 material sized as follows:

	Kick Plates:	8 x 2 LDW
Mop Plates:	4 x 2 LDW	
	Armor Plates:	16 x 2 LDW

2.3 SCHEDULE OF HARDWARE

A. See Hardware Schedule attached to this section.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Properly tag, index, and file all keys until turned over to the Owner. Apply hardware in accordance with templates and manufacturer's instructions; mortise and fit accurately; apply securely and adjust carefully.

1. Mount hardware units at heights recommended in "Recommended Locations for Builders Hardware" by DHI, except where shown otherwise on drawings.
2. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate.
3. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
4. Exercise care not to injure work when applying hardware. Review shop drawings and Contract Drawings for proper location. Cover door hardware with a heavy cloth until painting is completed. At completion of the work, examine doors and hardware, adjust as required and leave hardware in proper working order, free from defects.
5. At all times be responsible for the distribution of keys for hardware installed during construction, and cause all keys to be returned prior to final completion of the building

B. Preparation:

1. Do not install finish hardware until the wet trades have been fully completed.
2. Supplier shall mark each item of hardware for location. Protect markings until each item is installed. If any item of hardware is delivered to the Project not properly marked, return it to the supplier for marking before attempting to install it.
3. Install and make necessary adjustments for proper working order. Hardware damaged by improper adjustments or abuse will be rejected.
4. Provide clean, properly sized, and accurately placed mortises and drilled holes for all mortise and surface mounted finish hardware. Use appropriate jigs, templates, and power mortising equipment for the installation of all mortised hardware items.
5. Metal frames to receive hardware items shall be drilled and tapped accurately.
6. Removal for Painting:
   a. Before painters' finish is applied, remove all finish hardware except prime-coated items.

b. After final paint and finish coats are dry, permanently replace and adjust finish hardware for proper operation.

C. Thresholds:

1. Cut and fit threshold to profile door frames, with mitered corners and hairline joints. Screw thresholds to substrate with No. 10 or larger bronze or stainless steel screws.
2. Set thresholds in a bed of either butyl/rubber sealant or polyisobutylene mastic sealant to completely fill concealed voids and exclude moisture from every source. Do not plug drainage holes or block weeps. Remove excess sealant.

D. Weatherstrip: Accurately install weatherstrip to the door or frames where scheduled using proper type flush fasteners spaced not over 18" o.c. Installed work shall make continuous contact with the abutting surfaces and shall function for use intended. Adjust seals as required.

E. Mounting Heights: Shall be as follows, measured from finished floor except for top hinge which is measured from door top:

1. Bottom hinge: 10-3/8" [hinge center].
2. Top hinge: 9-3/4" [hinge center].
3. Intermediate hinges: Equally spaced between top and bottom hinges.
4. Locks and latches: 38" [operating spindle].
5. Pulls, pull and push plates: 42" [center].

3.2 ADJUST AND CLEAN:

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Lubricate moving parts with type lubricant recommended by manufacturer [graphite-type if no other recommended]. Replace units that cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.

B. Upon completion of the work and before final acceptance demonstrate that all hardware is in satisfactory working order, that all keys fit in their respective locks, and upon acceptance of the work, tag and deliver all keys to the Owner.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy and make a final check and adjustment of all hardware items in such space or area. Clean and re-lubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finish during the final adjustment of hardware.

SCHEDULE OF HARDWARE

HARDWARE SET #1

DOOR # 101, 102,

Single Door Exterior from Vestibule 105,108 3'0" x 7'0" 1 ¾" x AL x AL

EACH TO HAVE:

1ea.	Continuous Hinge	A110-83"	AL	ABH
1ea.	Exit Device	2108 x 2108A x SDS90 x BSHD90 x NFH090	626	PHI
1ea.	Rim Cylinder	12E72	626	BE
1ea.	Construction Core	1CC7A2 GR	626	BE
1ea	Door Closer	EHD9016 SDS x BSNFHD90	689	BE
1ea.	Door Bottom	C699A		NGP
1ea.	ADA Threshold	896S	AL	NGP
1ea.	Rain Drip	16A		
1ea.	Door Seal	by Storefront Supplier		

Note! Exit Device (08 function) Locked or Unlocked by Key with Hex Key Dogging
For Push Pull during operating hours.

HARDWARE SET #2

DOOR # 103, 104,

Single Door Vestibule 105,108 To Operators 100 3'0" x 7'0" 1 ¾" x AL x AL

EACH TO HAVE:

1ea.	Continuous Hinge	A110-83"	AL	ABH
1ea.	Exit Device	2108 x 2108A	626	PHI
1ea.	Rim Cylinder	12E72	626	BE
1ea.	Construction Core	1CC7A2 GR	626	BE
1ea	Door Closer	EHD9016 SDS x BSNFHD90 x NFH090	689	BE
1ea.	Door Bottom	C697A		NGP
1ea.	ADA Threshold	896S	AL	NGP
1ea.	Door Seal	by Storefront Supplier		

Note! Exit Device (08 function) Locked or Unlocked by Key with Hex Key Dogging
For Push Pull during operating hours.

HARDWARE SET #3

DOOR # 105

Single Door Exterior from Mechanical Room 104 3'6" x 7'0" 1 ¾" x HM x HM

EACH TO HAVE:

1ea.	Continuous Hinge	HD1100-83"	AL	NGP
1ea.	Mortise Lockset	45H7D 15 H	630	BE
1ea.	Construction Core	1CC7A2 GR	626	BE
1ea	Door Closer	EHD9016 SDST90	689	BE
1ea.	Kick Plate	AB-K1050 8" x 2" LDW	630	ABH
1ea.	Door Bottom	C699A		NGP
1ea.	ADA Threshold	896S	AL	NGP
1ea.	Door Seal	700NA	AL	NGP
1ea.	Rain Drip Guard	16A	AL	NGP

Note! Install Door Seal before Door Closer Installation.

HARDWARE SET #4

DOOR # 106

Single Door Men's Toilet Hall 101 to 106 3'0" x 7'0" x 1 ¾" x WD x HM

EACH TO HAVE:

1ea.	Continuous Hinge	HD1100-83"	AL	NGP
1ea.	Push Plate Healthy HDWE	AB-70F 8" x 16"	CN	ABH
1ea.	Hands Free Pull Healthy HDWE	AB-AP1007	CN	ABH
1ea.	Door Closer	EHD9016 AF90	689	BE
1ea.	Kick Plate	AB-K1050 8" x 2" LDW	630	ABH
1ea.	Mop Plate	AB-1050 6" x 1" LDW	630	ABH
1ea.	Sound Seal	5050B		NGP
1ea.	Wall Stop	AB-608	630	ABH
1ea.	Men's ADA Toilet Sign	AB-BFM689	BLK	ABH

HARDWARE SET #5

DOOR # 108

Single Door Women's Toilet Hall 102 to 108 3'0" x 7'0" x 1 ¾" x WD x HM

EACH TO HAVE:

3ea.	Butt Hinge	FBB179 4.5 x 4.5	630	BE
1ea.	Privacy Lockset	9K370L 15C	626	BE
1ea.	Door Closer	EHD9016 AF90	689	BE
1ea.	Kick Plate	AB-K1050 8" x 2" LDW	630	ABH
1ea.	Mop Plate	AB-1050 6" x 1" LDW	630	ABH
1ea.	Sound Seal	5050B		NGP
1ea.	Wall Stop	AB-608	630	ABH
1ea.	Women's ADA Toilet Sign	AB-BFM688	BLK	ABH

HARDWARE SET #6

DOOR # 107

Single Door Hall 102 to Storage 103 3'0" x 7'0" x 1 ¾" x WD x HM

EACH TO HAVE:

3ea.	Butt Hinge	FBB179 4.5 x 4.5	626	BE
1ea.	Storage Lock	9K37D 15C	626	BE
1ea.	Door Closer	EHD9016 AF90	689	BE
3ea.	Silencers	AB-609		ABH
1ea.	Wall Stop	AB-608	630	ABH

Note! Storeroom Lock; Locked at all times must have Key to Enter.

MANUFACTURER'S ABBREVIATIONS:

ABH	AMERICAN BUILDERS' HARDWARE
BE	BEST
NGP	NATIONAL GUARD PRODUCTS
PHI	PRECISION

FINISHES

AL	CLEAR ANODIZED ALUMINUM
BLK	BLACK
CN	COPPER NICKLE STAINLESS
622	MATT BLACK
626	SATIN CHROME
630	STAINLESS STEEL
689	ALMINUM

END OF SECTION 08710

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass.

B. Glazing compounds and accessories.

1.02 RELATED SECTIONS

A. Section 07 90 00 - Joint Sealers: Sealant and back-up material.

1.03 REFERENCES

A. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 1984 (R1994).

B. ASTM C 864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 1999.

C. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants; 2002.

D. ASTM C 1036 - Standard Specification for Flat Glass; 2001.

E. ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass; 1997b.

F. ASTM C 1172 - Standard Specification for Laminated Architectural Flat Glass; 1996.

G. ASTM C 1193 - Standard Guide for Use of Joint Sealants; 2000.

H. ASTM E 773 - Standard Test Method for Accelerated Weathering of Sealed Insulating Glass Units; 2001.

I. ASTM E 774 - Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units; 1997.

J. ASTM E 1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2000.

K. GANA (GM) - GANA Glazing Manual; Glass Association of North America; 1997.

L. GANA (SM) - FGMA Sealant Manual; Glass Association of North America; 1990.

1.04 PERFORMANCE REQUIREMENTS

A. Provide glass and glazing materials for continuity of building enclosure vapor retarder and air barrier:

1. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

B. Select type and thickness of exterior glass to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with North Carolina State Building code.

1. Use the procedure specified in ASTM E 1300 to determine glass type and thickness.
2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
3. Thicknesses listed are minimum.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Samples: Submit two samples 12 x 12 inch in size of glass units.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and FGMA Sealant Manual for glazing installation methods.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not install glazing when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide a five (5) year warranty to include coverage for sealed glass units from seal failure, inner pane dusting or misting, and replacement of same.

C. Provide a five (5) year warranty to include coverage for delamination of laminated glass and replacement of same.

PART 2 PRODUCTS

2.01 FLAT GLASS MATERIALS

A. See Glazing Schedule on drawings.

2.02 GLAZING COMPOUNDS

A. Manufacturers:

1. Dow Corning Corp: www.dowcorning.com.
2. GE Plastics: www.geplastics.com.
3. Pecora Corporation: www.pecora.com.
4. Substitutions: Refer to Section 01600 - Product Requirements.

B. Butyl Sealant: Single component; Shore A hardness of 10 to 20; black color; non-skinning.

C. Silicone Sealant: Single component; chemical curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C 920, Type S, Grade NS, Class 25, Uses M, A, and G; cured Shore A hardness of 15 to 25; color as selected.

2.03 GLAZING ACCESSORIES

A. Manufacturers:

1. Norton Performance Plastics Corp.
2. Pecora Corporation: www.pecora.com.
3. Tremco, Inc: www.tremcosealants.com.
4. Substitutions: Refer to Section 01600 - Product Requirements.

A. B. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C 864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4-inch x width of glazing rabbet space minus 1/16-inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore Adurometer hardness, ASTM C 864 Option I. Minimum 3-inch-long x one half the height of the glazing stop x thickness to suit application, self-adhesive on one face.

C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; as per mnfr inch size; black color.

D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C 864 Option I; black color.

E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Install sealants in accordance with ASTM C 1193 and FGMA Sealant Manual.

E. Install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION - EXTERIOR DRY METHOD (TAPE AND GASKET SPLINE GLAZING)

A. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

E. Trim protruding tape edge.

3.04 MANUFACTURER'S FIELD SERVICES

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

3.05 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.06 PROTECTION OF FINISHED WORK

A. After installation, mark pane with an 'X' by using removable plastic tape or paste.

END OF SECTION

SECTION 09 22 16

NON-LOADBEARING METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

1.02 RELATED SECTIONS

A. Section 09 26 00 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of walls, soffits, members, openings, attachments, and fasteners as required.
2. Connections not detailed.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C 754.

1.05 PROJECT CONDITIONS

A. Coordinate the placement of components to be installed within stud framing system.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing:

1. Clark Steel Framing Systems: www.clarksteel.com.
2. Dale/Incor: www.daleincor.com.
3. Marino-Ware: www.marinoware.com.
4. Substitutions: See Section 01600 - Product Requirements.

2.02 FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.

1. Studs: C shaped with knurled faces. 18”ga at structural stud walls and 20 ga for other walls.
2. Runners: U shaped, sized to match studs.
3. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

B. Tracks and Runners: Same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud.

C. Fasteners: ASTM C 1002 self-piercing tapping screws.

D. Anchorage Devices: Power actuated.

2.03 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

A. Extend partition framing to structure where indicated.

B. Align and secure top and bottom runners at 24 inches on center.

C. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

D. Install studs vertically at 16 inches on center.

E. Align stud web openings horizontally.

F. Secure studs to tracks using crimping method. Do not weld.

G. Fabricate corners using a minimum of three studs.

H. Double stud at wall openings, door and window jambs, not more than 2 inches from each side of openings.

I. Coordinate installation of bucks, anchors, and blocking with electrical and mechanical work to be placed within or behind stud framing.

3.03 CEILING AND SOFFIT FRAMING

A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

B. Install furring independent of walls, columns, and above-ceiling work.

C. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

D. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.

E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

F. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

3.04 ERECTION TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet.

B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.

B. Gypsum wallboard.

C. Fire-Rated Sealed Vinyl Laminated Gypsum Ceiling Board.

D. Joint treatment and accessories.

1.02 REFERENCES

A. ASTM C 36/C 36M - Standard Specification for Gypsum Wallboard; 2001.

B. ASTM C 475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2001.

C. ASTM C 630/C 630M - Standard Specification for Water-Resistant Gypsum Backing Board; 2000.

D. ASTM C 645 - Standard Specification for Nonstructural Steel Framing Members; 2000.

E. ASTM C 754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2000.

F. ASTM C 840 - Standard Specification for Application and Finishing of Gypsum Board; 2001.

G. ASTM C 931/C 931M - Standard Specification for Exterior Gypsum Soffit Board; 1998.

H. ASTM C 960/C 1396/ Type X. Class 1.

I. ASTM C 1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2001.

J. ASTM E 1264, Type XX, Patterns E, G.

K. ASTM C 1396/C 1396M - Standard Specification for Gypsum Board; 2001.

L. GA-201 - Using Gypsum Board for Walls & Ceilings; Gypsum Association; 1990.

M. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2000.

N. GA-600 - Fire Resistance Design Manual; Gypsum Association; 2000.

1.03 QUALITY ASSURANCE

A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.

1. Maintain one copy of standards at project site.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated assemblies as indicated on drawings.

1.05 PERFORMANCE REQUIREMENTS

A. At stairs, elevator hoistways, and other vertical shafts: L/120 at 10 psf.

B. At ground floor lobbies: L/120 at 15 psf.

C. At partitions to receive tile cladding, lath and plaster, or veneer plaster: L360/ at 15 psf.

D. At all other partitions: L/240 at 5 psf.

1.06 PROJECT CONDITIONS

A. Environmental Requirements: Establish and maintain application and finishing environment in accordance with ASTM C840.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gypsum Board:

1. G-P Gypsum Corporation: www.gp.com.
2. National Gypsum Company: www.nationalgypsum.com.
3. USG Corporation: www.usg.com.
4. Substitutions: See Section 01 60 00 - Product requirements.

2.02 GYPSUM DRYWALL FRAMING

A. Gypsum drywall framing shall include metal studs (minimum 20 gauge), metal furring for wall, metal furring for ceilings and accessories for gypsum suspended ceiling. All framing shall be in accordance with ASTM C 754 for size and gauge required or heavier if indicated on the Drawings.

2.03 DRYWALL

A. Drywall shall be 5/8" thick or ½" where indicated unless scheduled otherwise.

B. Drywall in bathrooms shall be water-resistant type.

C. Provide tile backer board at ceramic tile for showers and tubs.

D. Provide all exterior gypsum sheathing and soffit board where scheduled or required.

2.04 SHAFT WALL

A. Provide two hour rated "Shaft Wall" as manufactured by USG or approved equal where scheduled or required by code.

2.05 METAL FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Studs: C shaped with knurled faces. Minimum of 20 gauge.
   2. Runners: U shaped, sized to match studs.
   3. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

2.06 GYPSUM BOARD MATERIALS

A. Gypsum Board - All Types: Complying with applicable requirements of ASTM C 1396/C 1396M.

B. Standard Gypsum Wallboard: Sizes to minimize joints in place; ends square cut.
   1. Thickness: 5/8 inch.
   2. Edges: Tapered.

C. Fire Rated Gypsum Wallboard: Type X, UL or WH rated; sizes to minimize joints in place; ends square cut.
   1. Thickness: 5/8 inch.
   2. Edges: Tapered.

D. Water-Resistant Gypsum Backing Board: ASTM C 360/C 360MEnds square cut.
   1. Thickness: ½ inch.
   2. Edges: Tapered.

2.07 ACCESSORIES

A. Joint Materials: ASTM C 475 and as recommended by gypsum board manufacturer for project conditions.
   1. Powder-type vinyl-based joint compound.

B. Screws: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Comply with ASTM C 754 and manufacturer's instructions.

B. Studs: Space studs as permitted by standard.

1. Extend partition framing to structure where indicated and to ceiling in other locations.
2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

C. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.

3.03 GYPSUM BOARD INSTALLATION

A. Installation of Gypsum Board shall not commence until building envelope is complete. At all times, Gypsum Board shall be protected by weather and moisture.

B. Comply with ASTM C 840. Install to minimize butt end joints, especially in highly visible locations.

C. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

D. Single-Layer Fire-Rated: Install gypsum board vertically, with edges and ends occurring over firm bearing.

E. Double-Layer Installation: Use gypsum backing board for first layer, placed perpendicular to framing or furring members. Use fire rated gypsum backing board for fire rated partitions and ceilings. Place second layer perpendicular to first layer. Offset joints of second layer from joints of first layer.

F. Gypsum Soffit Board: Install perpendicular to framing, with staggered end joints over framing members or other solid backing.

G. Installation on Metal Framing: Use screws for attachment of all gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.05 JOINT TREATMENT

A. Finish all gypsum board in accordance with ASTM C 840 Level 5.

3.06 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 51 00

SUSPENDED ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide acoustical ceiling systems, complete as shown and as specified herein, including exposed tee suspension systems, acoustical lay-in boards concealed spline acoustical system.

B. Suspension system shall be designed to support respectively lay-in units and light fixtures with deflection of suspension members not to exceed 1/360 of span of member and shall be design/installed to the current seismic codes for the area.

C. Provide Acoustical Ceiling Tile Barrier for Noise Control.

1.02 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.04 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.06 PROJECT CONDITIONS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Install acoustical units after interior wet work is dry.

PART 2 PRODUCTS

2.01 MATERIALS

A. Components: Systems shall consist of main support tees, cross tees, splice clips, and wall angles.

1. Exposed Grid System: Equal to “Prelude” Exposed Grid System, as manufactured by Armstrong consisting of main tees and cross tees with 15/16” exposed flange. Wall molding shall be cold-rolled steel or aluminum, channel shaped, with 1” exposed face of same finish as exposed tee surfaces.
2. Exposed surfaces of tees and of wall molding shall be clear anodized aluminum finish or flat white, baked enamel finish.

2.02 ACOUSTICAL UNITS

A. Manufacturers:

1. Armstrong World Industries, Inc.

B. Acoustical Units - General: ASTM E 1264, Class A.

1. Acoustical Tile: Painted mineral fiber, ASTM E 1264 Type III, with to the following characteristics:
2. Ultima Fine Texture, #1911 Tegular Edge - 24” x 24” x ¾”. Grid 15/16”.
3. Optima Fine Texture, Tegular Edge - 24” x 24” x ¾”. Grid 15/16”.
4. Georgian, Beveled Tegular – 24 ”x 24” x 5/8”. Grid 15/16”.

2.03 SUSPENSION SYSTEM(S)

A. Manufacturers:

1. Armstrong World Industries.
2. Chicago Metallic Corporation.
3. USG Interiors/Donn Brand.
4. Suspension Systems - General: ASTM C 635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
5. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; Intermediate-duty.
    a. Profile: Tee; 15/16-inch-wide face.
    b. Finish: White painted.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.

1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C 636, ASTM E 580, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

1. Use longest practical lengths.
2. Overlap and rivet corners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:

1. Make field cut edges of same profile as factory edges.
2. Where round obstructions occur, provide preformed closures to match perimeter molding.

3.04 ERECTION TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, varnishes, and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

D. Do Not Paint or Finish the Following Items:

1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Floors, unless specifically so indicated.
6. Glass.
7. Concealed pipes, ducts, and conduits.

E. Cold galvanizing of structural steel members, assemblies and metal fabrications as an equivalent to hot-dip galvanizing and repair of hot-dip galvanizing.

1.02 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2012.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

D. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.06 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Provide panel, 4 feet long by 4 feet wide, illustrating special coating color, texture, and finish.

C. Provide door and frame assembly illustrating paint coating color, texture, and finish.

D. Locate where directed.

E. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

1. For Cold Galvanizing Compound, the humidity shall be less than 85% R.H.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.For Cold Galvanizing Compound: Surface temperature of the substrate to be coated shall be at least 50 above the dew point to avoid possible condensation. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instruction.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.09 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements for additional provisions.

B. Supply 1 gallon of each color, store where directed.

C. Label each container with color in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer.

B. Paints:

1. Sherwin-Williams Company: www.sherwin-williams.com.

C. Transparent Finishes:

1. Sherwin-Williams Company: www.sherwin-williams.com.
2. Minwax.

D. Stains:

1. Sherwin-Williams Company: www.sherwin-williams.com.
2. Minwax.

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.

1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Supply each coating material in quantity required to complete entire project's work from a single production run.
3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:

1. Provide coatings that comply with the most stringent requirements specified in the following:

    a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint WI-OP-3L - Wood, Opaque, Water-Based, 3 Coat:

1. One coat – Sherwin Williams Premium Wall & Wood Latex Primer, B28W8111
2. Two Coats Semi-gloss – Sherwin Williams Pro Industrial Waterbased Alkyd Urethane, B53-5150 Series

B. Paint WI-TR-VS - Wood, Transparent, Varnish, Stain:

1. One coat of stain – Minwax Performance Series Oil Stain
2. One coat sealer – Minwax Sanding Sealer

C. Paint CI-OP-3A - Concrete/Masonry, Opaque, Acrylic, 3 Coat:

1. One coat – Sherwin Williams PrepRite Latex Block Filler, B25W25
2. Two coats Semi-gloss – Sherwin Williams Pro Industrial Acrylic, B66-650 Series

D. Paint MI-OP-3A - Ferrous Metals, Unprimed, Alkyd/Acrylic System, 3 Coat:

1. One coat – Sherwin Williams Pro Industrial Kem Kromik Universal Primer, B50Z Series
2. Two Coats Gloss – Sherwin Williams Pro Industrial Acrylic Gloss, B66-610 Series

E. Paint MI-OP-2A - Ferrous Metals, Primed, Alkyd/Acrylic System, 2 Coat:

1. Touch-up with alkyd primer.
2. Two Coats Gloss – Sherwin Williams Pro Industrial Acrylic Gloss, B66-610 Series

F. Paint CI-OP-3E - Concrete/Masonry, Epoxy Enamel, 3 Coat:

1. One coat – Sherwin Williams Pro Industrial Heavy Duty Block Filler, B42W150
2. Two Coats Gloss – Sherwin Williams Pro Industrial Waterbased Catalyzed Epoxy, B73 Series

G. Paint GI-OP-3A - Gypsum Board/Plaster, Acrylic, 3 Coat:

1. One coat – Sherwin Williams ProMar 200 Zero VOC Primer, B28W12650
2. Two Coats Semi-gloss (Procedure Rooms) and Two Coats Eggshell (Other Area) – Sherwin Williams ProMar 200 HP Zero VOC Semi-Gloss, B31-2950 Series Sherwin Williams ProMar 200 HP Zero VOC Egshel, B20-2950 Series

2.04 PAINT SYSTEMS – EXTERIOR

A. Paint – CMU, Acrylic, 3 Coat:

1. One Coat – Sherwin Williams Loxon Acrylic Block Surfacer, LX01W0200
2. Two Coats Satin – Sherwin Williams Superpaint Exterior Acrylic, A89 Series

B. Paint – Concrete Walls, Acrylic, 3 Coat:

1. One Coat – Sherwin Williams Loxon Acrylic Concrete & Masonry Primer, LX02W0050
2. Two Coats Flat – Sherwin Williams Superpaint Exterior Acrylic Flat, A80 Series

C. Paint – Stucco/EIFS, Acrylic, 3 Coat:

1. One Coat – Sherwin Williams Loxon Acrylic Concrete & Masonry Primer, LX02W0050
2. Two Coats Flat – Sherwin Williams Superpaint Exterior Acrylic Flat, A80 Series

D. Paint – Steel, High-Performance Epoxy/Urethane, 3 Coat:

1. One Coat – Sherwin Willimas Macropoxy 646 Fast Cure Epoxy, B58 Series
2. Two Coats Gloss – Sherwin Williams Pro Industrial Acrolon 100 Urethane, B65

E. Paint – Galvanized Steel, High Performance Epoxy/Urethane System, 3 Coats

1. One Coat – Sherwin Williams Macropoxy 646 Fast Cure Epoxy, B58 Series
2. Two Coats Gloss – Sherwin Williams Pro Industrial Acrolon 100 Urethane, B65

F. Paint – Gypsum Board/Soffit, Latex, 3 Coats

1. One Coat – Sherwin Williams Exterior Latex Wood Primer, B41W8042
2. Two Coats Flat – Sherwin Williams Superpaint Exterior Latex Flat, A80 Series

G. Paint – PVC/Plastic, Water-Based, 3 Coats

1. One Coat – Sherwin Williams Extreme Bond Bonding Primer, B51W1150
2. Two Coats Semi-Gloss – Sherwin Williams Pro Industrial Acrylic, B66-650 Series

H. Paint – Wood, Oil/Acrylic System, 3 Coats

1. One Coat – Sherwin Williams Exterior Oil-Based Wood Primer, Y24W8020
2. Two Coats Satin – Sherwin Williams Superpaint Exterior Acrylic Satin, A89 Series

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Gypsum Wallboard: 12 percent.
2. Plaster and Stucco: 12 percent.
3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
6. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

H. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

I. Asphalt, Creosote, or Bituminous Surfaces to be Painted: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.

J. Concrete Floors and Traffic Surfaces to be Painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

K. Un-corroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

L. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent.Prime bare steel surfaces. Re-prime entire shop-primed item.

M. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

N. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

O. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

P. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

Q. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

B. Apply products in accordance with manufacturer's instructions.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Sand wood and metal surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

I. Coating of Cold Galvanizing Compound shall be applied by brush, roller, low pressure compressor-type spray or airless-type spray.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 SCHEDULE - SURFACES TO BE FINISHED

A. Mechanical and Electrical: Use paint systems defined for the substrates to be finished.

1. Paint all insulated and exposed pipes occurring in finished areas to match background surfaces, unless otherwise indicated.
2. Paint shop-primed items occurring in finished areas.
3. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
4. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

END OF SECTION

SECTION 102113.19
PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

1.02 RELATED REQUIREMENTS

A. Section 051200 - Structural Steel Framing: Concealed steel support members.

B. Section 055000 - Metal Fabrications: Concealed steel support members.

C. Section 061000 - Rough Carpentry: Blocking and supports.

D. Section 102800 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2026.

C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

D. ASTM A743/A743M - Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application; 2021.

E. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, floor, and ceiling supports, and door swings.

D. Samples: Two sample blocks, 6 by 6 inches (152 by 152 mm) in size, illustrating partition panel finish, color, and sheen.

E. Manufacturer's Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Manufacturer's qualification statement.

G. Executed warranty.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of professional engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 3 years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver, store, and handle materials and products in accordance with manufacturer's instructions and recommendations and industry standards.

C. Do not deliver materials or begin installation until building is enclosed, with complete protection from outside weather, and building temperature maintained at minimum of 60 degrees F (15.6 degrees C).

D. Store products indoors in manufacturer's or fabricator's original containers and packaging, with labels clearly identifying product name and manufacturer. Protect products from damage.

E. Lay cartons flat; support to ensure flatness and prevent damage to prefinished surfaces.

F. Do not store where ambient temperature exceeds 120 degrees F (49 degrees C).

1.08 FIELD CONDITIONS

A. Ambient Conditions: Maintain environmental conditions, such as temperature, humidity, and ventilation, within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 10-year manufacturer warranty for material against breakage, corrosion, and delamination. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments:
   1. All American Metal Corp - AAMCO: www.allamericanmetal.com/#sle.
   2. ASI Global Partitions: www.asi-globalpartitions.com/#sle.
   3. Partition Systems International of South Carolina; PolyLife HDPE Toilet Partitions: www.psisc.com/#sle.
   4. Scranton Products: www.scrantonproducts.com/#sle.
   5. Substitutions: Section 016000 - Product Requirements.

2.02 DESIGN CRITERIA

A. Accessibility: Comply with ICC A117.1 and ADA Standards.

2.03 SOLID PLASTIC TOILET COMPARTMENTS

A. General Description: Factory-fabricated doors, pilasters, and divider panels made of solid, molded, high-density polyethylene (HDPE); ceiling-hung.

B. Color: As selected by Architect.

C. Doors:
   1. Thickness: 1 inch (25 mm).
   2. Width: 24 inches (610 mm).
   3. Width for Handicapped Use: 36 inches (915 mm).
   4. Height: 55 inches (1397 mm).

D. Panels:
   1. Thickness: 1 inch (25 mm).
   2. Height: 55 inches (1397 mm).
   3. Depth: As indicated on drawings.

E. Pilasters:
   1. Thickness: 1 inch (25 mm).
   2. Width: As required to fit space; minimum 3 inches (76 mm).

F. Urinal Screens: Without doors; to match compartments; mounted to wall with two panel brackets.

2.04 FABRICATION

A. Fabricate toilet compartment components to sizes indicated in shop drawings.

B. Coordinate requirements and provide cutouts for through-partition toilet accessories.

C. Provide shoes and caps at pilasters and posts to conceal anchorage, supports, and leveling mechanisms.

D. Provide manufacturer's standard corrosion-resistant supports, leveling mechanisms, anchors, and anchoring assemblies for pilasters and posts.

E. Ceiling-Hung Units:
   1. Provide anchoring assemblies with leveling adjustment nuts at pilasters for connection to structural steel support, with two adjustable hanging studs above finished ceiling.
   2. Provide assemblies that support pilasters from structural steel without transmitting load to finished ceiling.

2.05 MATERIALS

A. High-Density Polyethylene (HDPE):
   1. Composition: Formed from waterproof, nonabsorbent, HDPE resins.
   2. Properties: Mark-resistant, self-lubricating surface.
   3. Material Fire Ratings: ICC (IBC), Class B.

B. Stainless Steel Sheet, Plate, and Bar: ASTM A240/A240M or ASTM A666/A666M, Type 304, stretcher-leveled standard of flatness.

C. Stainless Steel Castings: ASTM A743/A743M.

2.06 ACCESSORIES

A. Ceiling Attachment: Use two adjustable hanging studs, attached to above-ceiling framing.

B. Headrails: Extruded aluminum, anti-grip profile.
   1. Size: Manufacturer's standard size.

C. Attachments, Screws, and Bolts: Stainless steel, tamper-proof type.
   1. Wood Blocking and Supports: See Section 061000.

D. Hinges: Stainless steel, manufacturer's standard finish.

E. Door Hardware: Stainless steel, manufacturer's standard finish.
   1. Door Latch: Slide type with exterior emergency access feature.

F. Coat Hook: One per compartment, mounted on door.

G. Toilet Partition Suspension Members: See Section 055000.

H. Toilet Accessories: See Section 102800.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and interfaces with other work.

B. Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

C. Verify spacing of and between plumbing fixtures.

D. Verify location of built-in framing, anchorage, and bracing.

E. Verify substrate and site conditions for product installation are installed in accordance with manufacturer's written instructions.

F. Notify Architect in writing of conditions detrimental to completion of work. Do not proceed with installation until detrimental conditions are corrected.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's written instructions.

B. Maintain 3/8-to-1/2-inch (10 to 12 mm) space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate headrail joints at pilaster center lines.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/4 inch (6 mm).

B. Maximum Variation from Plumb: 1/8 inch (3 mm).

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).

B. Adjust hinges to position doors in partially open position when unlatched. Return outswinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 28 00

TOILET ROOM ACCESSORIES

PART 1 GENERAL

1.01 REFERENCES

A. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2000.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

1.03 COORDINATION

A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 PRODUCTS

2.01 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

1. Grind welded joints smooth.
2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

B. Keys: Provide two keys for each accessory to Owner, master key all lockable accessories or to match the predominate existing key system.

C. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof, security type.

B. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

C. Stainless Steel Sheet: ASTM A 666, Type 304.

2.02 TOILET ROOM ACCESSORIES

C. Toilet Paper Dispenser:

1. Bobrick B-2840 multi-roll stainless steel dispenser.

D. Paper Towel Dispenser:

1. ULINE Folded Towel Dispenser model H-2275 brushed steel.

E. Soap Dispenser:

1. Harney Hardware 40oz. stainless steel soap dispenser part # 19058

F. Mirrors:

1. Manufacturer: Bobrick.
2. Materials: Stainless steel framed, 6 mm thick float glass mirror.
3. Size: As indicated on drawings.
4. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; No.4 finish.
5. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
6. Shelf: Stainless steel; gage and finish to match mirror frame, turned down edges, welded to frame; 5 inch deep, full width of mirror.
7. Product: B-292 manufactured by Bobrick.

G. Grab Bars:

1. Stainless steel, 1-1/4 inches outside diameter, minimum 0.05 inch wall thickness, nonslip grasping surface finish, concealed flange mounting; 1-1/2 inches clearance between wall and inside of grab bar.
2. Length and configuration: As indicated on drawings.

PART 3 EXECUTION

3.01 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions.

B. Install plumb and level, securely and rigidly anchored to blocking in wall.

C. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings.

END OF SECTION

SECTION 10 44 13

FIRE EXTINGUISHERS, CABINETS AND ACCESSORIES

PART 1 GENERAL

1.01 REFERENCES

A. NFPA 10 - Standard for Portable Fire Extinguishers; National Fire Protection Association; 2002.

B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.02 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10.

B. Provide extinguishers and cabinets classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features and color and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers, Cabinets and Accessories:

1. JL Industries, Inc: www.jlindustries.com.
2. Larsen's Manufacturing Co: www.larsensmfg.com.
3. Potter-Roemer: www.potterroemer.com.
4. Substitutions: See Section 01 60 00 – Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Size cabinets to accept:

1. Dry Chemical Type: Stainless steel tank, with pressure gage.
   a. Class A, Size 10.
   b. Finish: Baked enamel, red color.

2.03 FIRE EXTINGUISHER CABINETS

A. Metal: Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Semi-recessed type.

1. Sized to accommodate accessories.
2. Trim: Returned to wall surface, with 2-1/2 inch projection, 1-1/4 inch wide face.

B. Door: 0.036 inch thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon catch.

C. Door Glazing: Glass, clear, 1/8 inch thick wired. Set in resilient channel gasket glazing.

D. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

E. Weld, fill, and grind components smooth.

F. Finish of Cabinet Exterior Trim and Door: Stainless Steel No. 4.

G. Finish of Cabinet Interior: White enamel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, at height required by NC Code Volume 1C.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

END OF SECTION

SECTION 220000 PLUMBING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

1. Work consists of furnishing all labor, material, equipment and services necessary and reasonably incidental to the proper completion and proper operation of the plumbing systems.

1.2 DEFINITIONS

A. Words and phrases used throughout the Contract Documents shall be interpreted as indicated below:

1. Contractor - The person or organization awarded the contract for construction services. In the case of a construction project administered as a multiple-prime contract, the term shall be further defined as the Contractor holding a prime contract for plumbing construction work. Any reference to “contractor” or “subcontractor” shall be superseded by the actual contractual arrangement used on the project.

2. The term "Plumbing Contractor" is used interchangeably with the term Contractor.

3. Provide - To furnish and install materials, equipment or systems.

4. Submittals - Submittals shall include Manufacturer's Catalog Data, Shop Drawings, Calculations, Certificates of Compliance, Testing Reports, Samples, and Operation and Maintenance Manuals.

5. Professional - The Architect and/or Engineer of record.

6. By other Trades: Shall mean by persons or parties who are not anticipated to be the contractor for this trade working together with the Prime Contractor. In this context the words “by other trades” shall not be interpreted to mean not included in the overall contract, unless specifically noted as not in contract (NIC).

1.3 CODES, REFERENCES AND STANDARDS

A. The Contractor shall comply with all laws, ordinances, and regulations of all Authorities Having Jurisdiction, including those of all applicable City, County, State, Federal and Public Utility entities. All licenses, permits, fees, connection fees, tapping fees, inspection fees, etc., shall be obtained by the Contractor and the cost shall be included in the Contract price.

B. The publications listed below form a part of this specification to the extent referenced. All publications shall be the latest edition as adopted by the Authority Having Jurisdiction. The publications are referred to in the text by basic designation only.

1. American National Standards Institute (ANSI) ANSI/NSF 372
   11 W. 42nd St.
   New York, New York 10036

2. American Water Works Association (AWWA)
   6666 West Quincy Avenue
   Denver, Colorado 80235

3.	Cement Mortar Lining for Ductile-Iron Pipe	ANSI A21.4	AWWA C104
4.	Rubber Gasket Joints for Ductile-Iron Pipe	ANSI A21.11	AWWA C111
5.	Ductile-Iron Pipe	ANSI A21.51	AWWA C151
6.	Cast Iron Screwed Fittings	ANSI B16.4	
7.	Cast Iron Drainage Fittings, Threaded	ANSI B16.12	
8.	Pipe Fittings, Bronze, and 250 lb. Cast	ANSI B16.15	
9.	Cast Copper Allow Solder-Joint Pressure Fittings	ANSI B16.18	
10.	Solder-Joint Fittings, Pressure Wrought Copper and Copper Alloy	ANSI B16.22	
11.	Cast Copper Alloy Solder-Joint Drainage Fittings	ANSI B16.23	
12.	Bronze Pipe Flanges and Flanged Fittings	ANSI B16.24	
13.	Solder-joint fittings, Drainage, DWV Wrought Copper and Copper Alloy	ANSI B16.29	

14. American Society of Heating Refrigeration (ASHRAE)
    and Air Conditioning Engineers
    1791 Tullie Circle NE
    Atlanta, GA 30329

15. American Society of Mechanical Engineers (ASME)
    345st 47th Street
    New York, New York 10017

16. Cast Copper Alloy Fittings for Flared Copper Tubes
    ASME Boiler and Pressure Vessel Code.
    Section IV Low Pressure Heating Boilers.
    Section VIII, Unfired Pressure Vessels.

17. American Society of Testing and Materials (ASTM)
1916 Race Street
Philadelphia, PA 19103

18. Cast Iron Soil Pipe and Fittings Hub and Spigot ASTM A74

19. Seamless Copper Water Tube ASTM B88

20. Copper Tube, Drainage DWV ASTM B306

21. Recommended Practices for Laying Sewer Pipe ASTM C-12

22. ASTM D1557, Method D and ASTM D1556S
Sand Cone Method

23. Billet-Steel Bars for Concrete Reinforcement, ASTM Spec. A-6l5

24. Cast Iron Soil Pipe Institute (CISPI)
1400 Chain Bridge Road
McLean, VA 22101

25. Cast Iron Soil Pipe and Fittings CISPI301
For Hubless Cast Iron Sanitary Systems

26. Manufacturer's Standardization Society (MSS)
5203 Leesburg Pike, Suite 502
Falls Church, VA 22041

27. Unions, Brass or Bronze, 250 pounds MSS-SP-72

28. Private Fire Service Main and Their
Appurtenances NFPA24

29. National Fire Protection Association (NFPA)
1 Batterymarch Park
Quincy, MA 02269

30. Flammable and Combustible Liquids Code NFPA 30

31. Standard on Fire Protection for Laboratories
Using Chemicals NFPA 45

32. National Fuel Gas Code NFPA 54

33. National Electrical Code NFPA 70

34. Handling Underground Releases of NFPA 329
Flammable and Combustible Liquids

35. North Carolina Department of Labor
Boiler and Pressure Vessel Division
4 West Edenton Street
Raleigh, North Carolina 27601-1092

36. The Uniform Boiler and Pressure Vessel Act of North Carolina and Administrative Rules

37. Plumbing and Drainage Institute (PDI)
5342 Boulevard Place
Indianapolis, IN 46208

38. Shock Absorbers PDI WH 201

39. North Carolina State Building Code.
    a. General Construction
    b. Plumbing
    c. Mechanical
    d. Energy

1.4 QUALITY ASSURANCE, WORKMANSHIP AND COORDINATION

A. The Contractor must coordinate their work with that of the other trades so that all will be performed in an orderly manner and with the least possible interference. Where coordination with other trades is required, the Professional shall make the final decision regarding changes to be made in the work.

B. The Contractor must thoroughly familiarize themself with all specifications and drawings for the project so that they clearly understand their responsibility in relationship to the work to be performed. The Contractor must plan and perform their work so as to permit the use of the building at the earliest possible date.

C. The Contractor shall guarantee the workmanship, materials and equipment, furnished against defects, leaks, performance and non-operation for a period of one (1) year after the date of final acceptance. Defective workmanship shall be construed as meaning defective materials and unsatisfactory installation and not intended to apply to ordinary wear and tear. The Contractor shall pay for any repairs or replacements caused by defective workmanship as construed herein within the period covered by the Guarantee, including all incidental work required to correct the deficiency.

D. The Contractor shall expressly and completely follow all manufacturer instructions required for validation of the manufacturer's warranty agreement including but not limited to service, maintenance and adjustments of the equipment.

E. The Contractor will be held responsible for the proper installation of all materials and equipment required for a complete installation within the intent and meaning of the Contract Documents.

F. Should any change in plans or specifications be required to comply with governing regulations, the Contractor is to notify the Professional at least 10 days prior to the bid date.

G. All bidders shall visit the site prior to submitting a bid. Any existing condition which should be obvious to an experienced bidder shall be deemed to be included in the bid. Failure of any bidder to visit the site shall not relieve them of this responsibility.

1.5 PROJECT RECORD DRAWINGS

A. Changes from the Contract Drawings necessary to coordinate the work with other trades, to conform to the building conditions or to conform to the rules and regulations of Authorities Having Jurisdiction shall be made only after obtaining written permission from the Professional.

B. The Contractor shall keep a record of construction changes and deviations from the original Contract Drawings. All changes shall be recorded on a separate set of blueprints and shall be kept at the job site specifically for that purpose. The record shall be made immediately after the work is completed.

C. Documentation shall include:

1. location and elevation of new and existing utility lines
2. points of connection to existing utility lines
3. changes in pipe routing location
4. valve locations
5. equipment locations, etc.
6. actual capacities and values of equipment provided as indicated in equipment schedules.
7. The marked-up record set of drawings shall be delivered to the Professional before final acceptance of the Plumbing Contract work.

1.6 FIELD MEASUREMENTS

A. It shall be the Contractor's responsibility to verify the location of any and all existing underground utilities in the vicinity of his work. When it has been indicated that these utilities are to remain in place, the Contractor shall provide adequate means of support and protection during excavation operations.

B. Before ordering any equipment and material, or performing any work, the Contractor shall verify all measurements and dimensions at the job site and shall be held responsible for the correctness of same.

C. No extra compensation will be allowed on account of differences between actual dimensions and measurements and those indicated on the drawings.

D. Any differences which are identified shall be submitted to the Professional for consideration before proceeding with the work.

1.7 PROTECTION OF SERVICES AND EQUIPMENT

A. The Contractor, at their own expense, shall repair, replace and maintain in service any utilities, facilities or services (underground, aboveground, interior or exterior) damaged, broken, or otherwise rendered inoperative during the course of construction due to activities on the part of the Contractor. The method used by the Contractor in repairing, replacing or maintaining the services shall be approved by the Professional.

B. The Contractor shall protect, at their own expense, such of their work, materials or equipment that is subject to damage during the project duration. All openings into any piping, ducts or equipment must be securely covered, or otherwise protected, to prevent injury due to carelessly or maliciously dropped tools or materials, grit, dirt, or any foreign material. The Contractor shall be held responsible for all damage so done until his work is fully and finally accepted.

C. It shall be the responsibility of the Contractor to protect motors, pumps, electrical equipment, and all similar items of equipment from dirt, grime, plaster, water, etc. during all phases of construction. This protection shall be provided by covering equipment with transparent plastic sheeting and/or locating the materials and equipment in an area free from the elements.

1.8 INTERRUPTION OF SERVICES

A. Occupancy: The work is to be performed in and around existing facilities that are occupied by the public as a place of business. The work shall be coordinated and scheduled with the Owner and/or Owner's representatives to minimize any disruption to normal functions and occupancy of the facility.

B. The Contractor shall schedule their work to avoid any major interruption of any utility services.

C. Existing utilities serving facilities occupied and used by the Owner or others shall not be interrupted except when such interruptions have been authorized in writing by the Owner or the Professional. Interruptions shall occur only after an acceptable temporary utility services have been provided. The Contractor shall provide a minimum of ten (10) working days notice to the owner and receive notice to proceed before interrupting any utility.

1.9 PRODUCT SUBMITTALS

A. General: Refer to the Division 1 sections for general requirements concerning work-related submittals. In addition to those general requirements, the following are required for Division 23 submittals. Failure to comply with these requirements may result in rejection without further review.

1. Manufacturer or Vendor terms and conditions of sale are strictly between Vendor and Contractor. Approval of submittal data shall not be construed as approval of terms and conditions.

   By providing submittals to the contractor to be forwarded to the engineer for

review, the equipment vendor is acknowledging review of the contract documents and installation details, and that the submitted product is suitable for application in the manner indicated in the contract documents. Upon request, and at no additional charge, the equipment vendor will provide to the engineer a letter from the manufacturer stating the product has been applied in accordance with manufacturer's recommendations.

B. Product Data, Shop Drawings and Samples: After checking and verifying all field measurements, the Contractor shall submit to the Engineer for review, in accordance with the accepted schedule of shop drawings submissions, copies of all product data, shop drawings and samples, which shall have been checked by and stamped with the approval of the Contractor and identified as the Engineer may require. The data shown on the shop drawings will be complete with respect to dimensions, design criteria, materials of construction and the like to enable the Engineer to review the information as required.

1. The Contractor shall review each submittal in detail. The work described in shop drawing submission shall be carefully checked for clearances (including those required or recommended for maintenance and servicing), field conditions, maintenance of architectural conditions and proper coordination with other trades on the job. If it is determined to be correct, the Contractor shall place an approval stamp on each copy; approval stamp shall be filed in with the date on which the items is checked and the checker's name. The Contractor's approval stamp certifies that submittals and related job conditions have been checked and that conflicts do not exist. Any job conflicts arising from the contractor's failure to fully complete these responsibilities shall be corrected as directed by the Professional at no additional cost to the contract. Drawings which the Contractor finds are incomplete or incorrect shall be returned to the source without being forwarded to the Professional. Drawings which do not contain the signed Contractor's stamp may be returned unchecked to the Contractor. Return of unchecked submittals and any delays in construction it may cause, will not be considered cause for any extensions or delays in construction by the Contractor.
2. Shop drawings shall be submitted well in advance of field requirements to allow ample time for checking. Submittals shall be complete and contain required detailed information. Shop drawings with multiple parts shall be submitted as a package.
3. Include with each submittal a permanent cover sheet for identification. Provide the following information on the cover sheet for proper processing and recording of action taken. A sample cover sheet can be made available by the Engineer for reproduction and use for each submittal.
    a. Project name;
    b. name and address of Professional;
    c. name and address of Contractor;
    d. name and address of supplier;
    e. Sequential submittal number (e.g. FP-1, M-1, P-1, P-2, P-3, etc.); resubmittals shall be designated with the same submittal number but noted as a resubmittal (e.g. FP-1R, M-1R, P-1R, P-2R, P-3R, etc.);
    f. name of manufacturer;
    g. number and title of appropriate specification section, drawing number identifying symbol, and detail references, as appropriate.

h. similar definitive information as necessary.
i. space for the Contractor's review and approval markings
j. space for the Professional "Action" marking

4. Submit materials and equipment by manufacturer, trade name and model number. Include copies of applicable brochure or catalogue material. Do not assume applicable catalogues are available in the Professional's office. Maintenance and operating manuals are not suitable substitutes for shop drawings.
5. Identify each sheet of printed submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information. Note specified features such as special tank linings, pump seals, materials or painting.
6. Include dimensional data for roughing in and installation, technical data sufficient to verify that equipment meets requirements of drawings and specifications. Include wiring, piping and service connection data, motor sizes complete with voltage ratings and schedules.
7. Installed materials and equipment shall meet specified requirements regardless of whether or not shop drawings are reviewed by the Professional.
8. Furnish all submittals for the items used in this project as listed in their related sections.
9. The Contractor shall also submit to the Engineer for review, with such promptness as to cause no delay in work, all samples required by the Contract Documents. All samples shall have been checked by and stamped with the approval of the Contractor, identified clearly as to material, manufacturer, any pertinent catalog numbers and the use for which intended.
10. At the time of each submission, the Contractor shall in writing call the Engineer's attention to any deviations that the shop drawings or sample may have from the requirements of the Contract Documents. Make specific mention of such difference in a letter of transmittal, with request for substitution, together with reasons for same.
11. The Engineer shall review with reasonable promptness shop drawings and samples, but their review shall be only for conformance with the design concept of the project and for compliance with the information given in the Contract documents.
12. No work requiring a shop drawing or sample submission shall be commenced until the submission has been reviewed by the Engineer. A copy of each shop drawing and each approved sample shall be kept in good order by the Contractor at the site and shall be available to the Engineer and other authorities having jurisdiction.
13. The Engineer's review and acceptance of submitted data or shop drawings for material equipment apparatus, devices, arrangement and layout shall not relieve Contractor from responsibility of furnishing the proper dimensions and weight, capacities, sizes, quantity, quality and installation details to efficiently perform the requirements and intent of the Contract. Approval shall not relieve the Contractor from responsibility for errors, omissions or inadequacies of submitted data or shop drawings.
14. Upon final approval of shop drawings, the Contractor shall submit manufacturer's installation instructions to the Local Building Authority for all equipment and appliances at their request.
15. Upon final approval of shop drawings, the Contractor shall submit a record copy of

all applicable items to the Balancing Agency.

16. If any components for which shop drawings have been approved is later found to not comply with those shop drawings contractor shall be responsible for all costs to address this, including but not limited to charges from the owner, engineer and other contractors.

1.10 SUBSTITUTION

A. Follow requirements listed in the general provisions of the contract.

B. Submittals are not opportunities for gaining acceptance of substitutions. Where three or more manufacturers are specified by name or by catalog reference, Contractor shall select for use any of those so specified.

C. Contract documents are based on materials and equipment specified. Approval by Professional of equipment submitted by the mechanical trade as equal to that specified does not relieve the mechanical trade of any responsibility.

D. Revisions required to adapt alternative shall be included in such proposals. No increase in the contract price will be considered to accommodate the use of the equipment other than that specified.

E. Wherever operating results such as quantity delivered, pressure obtained, or similar results are specified, or a definite manufacturer and size of apparatus is specified, for which such quantities are readily determinable, the manufacturer and size of apparatus that the Contractor has proposed using must conform substantially (in regard to the operating results) to the quantities specified or implied. This requirement shall also apply to important dimensions relating to operation of apparatus in coordination with the rest of the system, and to properly locating the apparatus in available space conditions.

F. Acceptance of substitutions for equipment specified shall be given only after receipt of complete and satisfactory performance data covering the complete range of operating conditions in tabular and graphical form. Furnish complete and satisfactory information relative to equipment dimensions, weight, etc. Acceptance of equipment specified or shown on the Drawings, or substitutions submitted for that specified or shown on the drawings, will be granted if such equipment, in the opinion of the Professional, conforms to the performance requirements, space conditions, weight requirements and quality requirements. Acceptance by the Professional as “equivalent” does not relieve the contractor(s) of any responsibility. Any additional construction and design costs incurred as a result of any accepted substitution shall be borne by the Contractor.

1.11 TRADE PRODUCT SUBSTITUTION

A. It is the intent of this specification that all qualified suppliers be provided a fair opportunity to bid work, regardless of whether they are named in the specification.

B. Where manufacturers are named it is to establish a general level of quality and features. Proposed substitutes must be equivalent to those named performance, sound, materials and means of construction, finishes, etc.

C. Should Contractor desire to substitute another manufacturer's equipment for one specified by name, the Contractor shall apply to the Engineer in writing no later than 10 days prior to bid opening for such permission. They shall provide supporting data and samples for Engineers consideration. No substitution shall be made for any material, article or process required under the contract unless approved by the Engineer.

1.12 ELECTRICAL WORK BY PLUMBING CONTRACTOR

A. All electrical work which is the responsibility of this contractor shall comply with electrical specifications and NEC.

PART 2 - PRODUCTS

2.1 GENERAL

A. Refer to the specific specification sections contained in the following sections for product requirements.

B. All materials used on plumbing systems shall comply with the following lead ban requirements:

1. Solders with lead content exceeding 0.2% (two-tenths of a percent) are prohibited. Brass and bronze materials containing 0.25% (25 hundredths of a percent) or greater lead are prohibited. All lead content shall be per ANSI/NSF 372.
2. All materials shall be compliant with the 2011 “Reduction of Lead in Drinking Water Act”.
3. Components that are specifically exempted in the Act, such as water closets, urinals, flush valves and shower valves need not comply.
4. This provision shall supersede any provision to the contrary elsewhere in the contract documents.

2.2 CONCRETE

A. Concrete shall comply with Division 3 of the Project Manual.

2.3 MISCELLANEOUS STEEL AND ACCESSORIES

A. The Contractor shall provide all necessary steel angles, channels, pipe, rods, nuts, bolts, etcetera, as shown on plans, as specified, or as may be required for complete and proper installation of plumbing fixtures, systems and equipment. All material and workmanship shall be of the best quality and shall be installed in accordance with the best practices of the trade.

2.4 ACCESS PANELS

A. The Contractor shall furnish access doors to the General Contractor for installation in ceilings, walls, partitions and floors for access to valves, traps, fittings, and all appurtenances.

B. Access panels shall be of sufficient size to permit removal or access to equipment, except that the minimum size shall be 12-inches by 16-inches.

C. Access door locations shall be as determined by field conditions for optimum access to equipment, and shall be reviewed by the Professional before final installation, and shall be subject to the following:

1. Bottom of access doors shall not be lower than the top of the partition base, or a minimum of 6 inches above floor.

2. Tops and/or sides of access panels shall be a minimum of 6-inches from the ceiling or opening or from the edge of a wall return.

3. Access doors shall be suitable for installation in the finish material of the ceilings, walls, partitions and floors.

4. Frame and panel access doors in restrooms, kitchens and as indicated shall be stainless steel.

5. Access doors with UL Listing shall be provided in rated construction assemblies. Access doors shall be "B-Label" and shall have a UL one and one-half (1-1/2) hour rating at 250 degrees F rating for both door and frame. Maximum size shall be 20" x 20" or 400 square inches in area. Frame shall be sixteen (16) gauge minimum steel, panel shall be twenty (20) gauge minimum steel. Access doors shall be provided with a baked-on enamel finish (prime coat), continuous type hinge on one side, flush-face type lock with key operation and self-latching cylinder locks.

6. Access doors without UL label shall be provided in all non-rated construction assemblies: Frame shall be sixteen (16) gauge minimum steel, panel shall be fourteen (14) gauge minimum steel. Access doors shall be provided with a baked-on enamel finish (prime coat), concealed spring type hinges and flush-face type lock with key operation and self-latching cylinder locks. Door shall open 175 degrees (minimum).

7. All access doors shall be keyed alike.

PART 3 - EXECUTION

3.1 GENERAL

A. All materials and equipment used shall be installed in strict accordance with the Standards under which the materials are accepted and approved, and in strict accordance with the manufacturer's instructions.

B. The Contract Documents are not intended to indicate every bend, offset, change in direction and appurtenance required to provide a complete and workable system.

C. The contract drawings are diagrammatic and are indicative of the work to be performed. It is not intended that they show every pipe, fitting or apparatus required for a complete installation.

D. Except where otherwise indicated, minimum cover shall not be less than the following:

1. Sanitary sewer piping: 3'-0"
2. Storm sewers: 1'-0"
3. Water piping: 3'-0"

3.2 EXCAVATION, BACKFILLING AND COMPACTION

A. The Contractor shall notify ULOCO prior to any work.

B. The Contractor shall perform all excavation, backfilling, compaction and necessary finishing for all piping, equipment, and accessories. Piping installation shall be in accordance with local water, sewer and gas utility regulations and applicable State and Local codes.

C. The Contractor shall do all bracing, sheathing and shoring necessary to perform and protect excavations. The Contractor shall provide safety rails, lights, signs, etc. as necessary or required for safety or as required to conform to governing laws.

D. The Contractor shall provide, maintain, and operate pumping equipment of sufficient capacity to insure that all excavations and trenches are kept free of water at all times.

E. All surfaces of streets, walkways, seeded areas, or finished grade areas disturbed by the excavation shall be restored to their original condition and/or as indicated on the Project Documents.

F. Protect existing structures, utilities, sidewalks, pavements and other facilities not indicated for removal, from damage caused by settlement, lateral movement, undermining, washout and other hazards resulting from excavation operations.

G. Existing utility lines shown on the Project Documents do not indicate the exact in-place location of the lines. They do not show every pipe, fitting or appurtenance that may exist at the project site. The location and depth of all utilities shall be marked and recorded prior to any excavation. Should uncharted or incorrectly charted, existing piping or other utilities be uncovered during excavation, contact the Professional immediately for directions before proceeding further with work in this area. Cooperate

with owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner.

H. If it becomes necessary to install any lines or equipment in locations other than those shown, the Professional's acceptance shall be obtained before starting the excavation.

I. The presence of explosives on the project site or the use of explosives in the execution of the work under this contract is not permitted.

J. Excavation:

1. All plumbing excavation is unclassified.

2. Trenches shall be dug to uniform width not less than 12-inches or more than 16-inches wider than the bell diameter of the piping. Trench sides shall be vertical, Except 4'-0"and deeper shall be excavated with sides sloped at a 45 degree angle beginning one foot above bottom of trench to prevent cave-ins. Other OSHA approved methods of preventing cave-ins may be employed by the contractor. Excavate trenches to depth indicated or required. Carry depth of trenches for piping as required to establish required slopes and invert elevations. Beyond building perimeter, keep bottom of trenches sufficiently below finished grade to protect against frost. The bottom of trenches shall be accurately graded to provide uniform and smooth flow throughout. Any over-excavation shall be backfilled with modified aggregate and thoroughly tamped.

3. If trench excavation operations are performed when the atmospheric temperature is less than thirty-five (35) degrees Fahrenheit, the Contractor shall provide at his own expense cold weather protection as required to protect excavated trench bottoms from freezing. Under no circumstances will any pipe be permitted to be laid in a trench containing water or on a subgrade containing frost.

4. Take up and re-lay pipe that is not laid true to required alignment or grade. Pipe that has had it's joints disturbed after laying shall be taken up and re-laid. Deviation from the required lines and grades will not be permitted unless approved by the Professional.

5. Pipe Embedment - All pipe shall be laid on a First Class granular bedding. The bedding shall be a minimum depth of 6-inches (six) or 1/4 (one-fourth) the pipe diameter, whichever is greater. The bedding shall provide uniform longitudinal support to the pipe and shall be laid to provide the grade and line as shown on the drawings or as directed by the Professional. Compaction of embedment materials under the haunches and around the pipe to the springline of the pipe shall be by hand tamping. Final embedment for ferrous pipe materials shall extend from the springline of the pipe to a depth of 6-inches (minimum) above the top of the pipe. Final embedment for PVC pipe shall extend from the springline of the pipe to a depth of 18-inches (minimum) above the top of the pipe.

6. Backfilling shall not be undertaken until all tests and inspections have been made. Use care to avoid damaging or displacing piping systems. All backfill material shall

be free from cinders, ashes, refuse, organic material, boulders, rocks or stones, frozen soil, or other material that is unsuitable. When the type of backfill material is not indicated on the plans or is not specified, the excavated material may be used, provided that such material consists of loam, clay, sand, gravel, or other material that is suitable for backfilling. From 1-foot above the top of the pipe to the subgrade of the pavement, material containing stones greater than 6-inches in their greatest dimension may not be used.

7. Backfilling shall be carefully performed and the original surface restored.

8. All trench backfill shall be brought to subgrade ready for base material or topsoil. After the initial aggregate backfill layer has been placed, refill remainder of the trench using backfill materials as follows:

    a. Lawns - Successive 6-inch layers of clean earth backfill material shall be deposited after initial aggregate backfill. This backfill shall consist of excavated material free from large clods of earth and stone. If large stones (greater than 6-inches) are encountered, remove stones from site and haul in clean earth backfill. The entire trench shall be uniformly tamped after each successive layer is deposited. Replace topsoil to approximate depth of existing as final refill operation and crown to such height as required by the Professional. Maintain crowned surface to the satisfaction of the Professional.

    b. Walks and Parking Areas - Clean earth backfill compacted in 6-inch layers to a point 8-inches below the adjacent existing surfaces. Refill the remaining 8-inches with compacted stone and replace walk or paving as required.

9. Thoroughly compact subgrade prior to the installation of 6-inches of First Class pipe bedding. Following satisfactory pipe laying and in-line structure installation, backfill trenches to a height of at least 12-inches above the top of the outside barrel of the pipe.

10. All fill shall be compacted to ninety-five (95) percent. Each layer shall be compacted to the specified percent of maximum density obtained at optimum moisture content, in accordance with ASTM D1557, method D and ASTM D1556 sand cone method.

11. Compaction shall be accomplished by approved equipment suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

12. Thoroughly compact successive layers of backfill material with a vibrating compactor of a type and size satisfactory to the Professional. Compacting of this backfill by puddling or jetting will not be permitted. Use mechanical tampers to compact backfill materials in trench refill operations to produce a density of backfill at the bottom of each layer of not less than 95-percent of the maximum density obtained at optimum moisture content.

13. All underground lines installed outside of building footprint shall have a magnetic type warning tape installed in the backfill 12” to 18” below grade.

3.3 CUTTING, PATCHING, FINISHING

A. Unless otherwise noted, the Contractor shall cut, patch and finish all chases and openings required for the installation of work to be performed under this Contract. All patching and finishing shall match existing adjacent undisturbed surfaces.

B. Cutting shall not cause damage to the building or leave unsightly surfaces. Where such unsightly conditions are caused by the Contractor, he shall be required to repair these.

C. The Contractor shall contact the holder of the guarantee and obtain written approval before cutting the roofing membrane so as not to void said guarantee.

D. No structural member shall be cut.

E. Penetrations made in existing fire rated chases, partitions, floors, etc. shall be sealed with an approved material and method as required to maintain the integrity of the fire separation.

F. All materials and methods to be used for patching and repairing shall be subject to the approval of the Professional and the Owner's Authorized Representative.

G. The Contractor shall set all sleeves, hangers, and anchors required for the Plumbing Contract work and shall be responsible for their proper and permanent location.

H. No cutting shall be done which may affect the building structurally or architecturally without first securing the approval of the Professional. Cutting shall be accomplished in such a manner as not to cause damage to the building or leave unsightly surfaces which cannot be concealed by plates, escutcheons or other construction. Where such unsightly conditions are caused, the Contractor shall be required, at his own expense, to repair the damaged areas.

I. Cutting of the construction excessively or carelessly done shall be repaired to match the original work by the Contractor and to the satisfaction of the Professional who will make the final decision with respect to excessive or careless cutting work. The Contractor shall seal all openings he has made in plenum spaces, fire rated floors, ceilings or partitions after his work has been installed. The material used for sealing the openings shall have a fire rating equal to or greater than the rating of the floor, ceiling or partition material.

3.4 CHASES AND OPENINGS

A. All chases and openings required for the installation of the work shall be coordinated with the other trades. The Contractor shall provide the other trades with sufficient time

(1 (one) week minimum) for coordination of all chases and openings. The Contractor shall be responsible for all work required to cut and patch the required openings. The work shall be performed to the satisfaction of the Professional.

B. Penetrations made in fire rated chases, partitions, floors, etc. shall be sealed with an approved material and method as required to maintain the integrity of the fire separation.

C. The Contractor shall provide all sleeves, hangers, and anchors required for installation of the work in chases and openings.

3.5 INSPECTION AND TESTING

A. General: New plumbing systems and parts of existing systems which have been altered, extended or repaired shall be tested to disclose leaks and defects.

B. If the Professional determines that the plumbing systems do not pass the prescribed tests, then the Contractor shall be required to make the necessary repairs, at their own expense, and the Contractor shall re-inspect and re-test the systems. Repairing, inspection and testing shall be continued until all systems pass as determined by the Professional.

C. All new, altered, extended or replaced plumbing shall be left uncovered and unconcealed until it has be inspected, tested and accepted by the Professional. Where such work has been covered or concealed before it has been inspected, tested and accepted, it shall be uncovered by the Contractor, at their own expense as directed by the Professional.

D. All equipment, material, labor, etc., required for testing the plumbing systems shall be furnished by the Contractor.

E. Sanitary, Vent, and Rainwater Collection Systems: The systems shall be tested in accordance with the North Carolina State Plumbing Code.

F. Finished Plumbing: After the plumbing fixtures have been set and their traps filled with water, the plumbing fixture connections shall be tested and proved gas and watertight.

G. A pressure test of the building sewer shall be performed in accordance with the requirements of NC State building code.

H. Building Sewer: The building sewer shall be tested by insertion of a test plug at the point of connection with the existing exterior sewer system. The building sewer shall then be filled with water under a head of not less than 10-feet. The water level at the top of the test head of water shall not drop for at least 15 (fifteen) minutes.

I. Domestic Water Systems:

1. The system shall be tested either in its entirety or in sections.
2. The system shall be tested and proved tight under a water pressure of 150 pounds per square inch for a period of 2 hours.
3. Potable water shall be used for testing.

3.6 STERILIZATION OF THE DOMESTIC WATER SYSTEM

A. After the system has been tested and approved, the entire new system, including valves and accessories, shall be chlorinated. Disinfecting to be in accordance with AWWA C651. The contractor shall provide test reports from and independent laboratory confirming the absence of bacterial coliform.

B. Calcium hypochlorite and water mixture

1. Calcium hypochlorite shall be HTH, Perchlorene and Maxochlor, or accepted substitute. A solution consisting of five (5%) percent powder to ninety-five (95%) percent water by weight shall be prepared. The calcium hypochlorite and water mixture, first made into a paste and then thinned to a slurry, shall be injected or pumped into the system.

2. The system or part thereof shall be filled with a water/chlorine solution containing at least 50 parts per million of chlorine. The system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million of chlorine and allowed to stand for 3 hours. During the chlorination process all valves and accessories shall be operated.

3. After the chlorination process, the chlorine shall be flushed from the system until the system water is equal chemically and bacteriologically to those of the permanent source of water supply.

C. Laboratory tests of the water shall be paid for by the Contractor.

D. The “Water Test Report for Use” suitable to the local health authority is required to be submitted prior to Beneficial Occupancy permit.

3.7 INSTRUCTION OF THE OWNER

A. After acceptance of the Project, the Contractor shall furnish the services of personnel thoroughly familiar with the completed installation to instruct the Owner in the proper operation and maintenance of all equipment and appurtenances provided.

B. The Contractor shall provide the Owner with two weeks advance notice before the instruction session.

3.8 PAINTING

A. Painting shall be in accordance with Architectural specifications.

3.9 CLEANUP

A. The Contractor shall maintain buildings, grounds and public properties free from accumulations of waste materials, debris and rubbish. At reasonable intervals during

the progress of work, and when directed by the Owner's Authorized Representative, the site and public properties shall be cleaned and waste materials, debris and rubbish shall be disposed of in appropriate manner. The Contractor shall provide containers for collection of waste materials, debris and rubbish. Waste materials, debris and rubbish shall be removed from the job site and legally disposed of at a landfill area in accordance with all applicable regulations. Burning or burying waste materials, debris or rubbish on project site shall not be permitted.

B. At the completion of the Project, remove waste materials, rubbish, tools, equipment, machinery, surplus materials, etc., and clean all sight-exposed plumbing fixtures and equipment. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight-exposed plumbing fixtures and equipment. Broom clean paved and concrete surfaces; rake clean other ground surfaces. Repair, patch and touch up marred surfaces to the specified finish or to match adjacent surfaces.

C. The Contractor shall maintain sufficient forces to respond promptly to any system problems that occur during construction and during the warranty period. The Contractor shall provide the Owner and the Engineer with reliable and prompt means of contacting the Contractor. In the event that after an attempt to contact the Contractor, the Contractor does not respond appropriately to any problem, the Owner and/or Engineer will without further notice address the problem. All costs associated with addressing the problem will be borne by the Contractor including all costs of the engineer and owner and including all risk of damage to equipment except that caused by gross negligence of others.

3.10 MAINTENANCE OF LOCAL SERVICE ORGANIZATION:

A. The Contractor shall maintain sufficient forces to respond promptly to any system problems that occur during construction and during the warranty period. The Contractor shall provide the Owner and the Engineer with reliable and prompt means of contacting the Contractor. In the event that after an attempt to contact the Contractor, the Contractor does not respond appropriately to any problem, the Owner and/or Engineer will without further notice address the problem. All costs associated with addressing the problem will be borne by the Contractor including all costs of the engineer and owner and including all risk of damage to equipment except that caused by gross negligence of others.

END OF SECTION 220000

SECTION 220503 ELECTRICAL REQUIREMENTS OF PLUMBING SYSTEMS

PART 1 - GENERAL REQUIREMENTS

1.1 SECTION INCLUDES

A. General: The contents of this section describe the division of work and product requirements for work normally recognized as electrical but required for mechanical work including, but not necessarily limited to:

1. Motors
2. Motor Starters
3. Power and Control Wiring
4. Emergency Stop Switches (ESS).

1.2 DIVISION OF WORK

A. This section delineates the division of electrical work between Division 22 and 26.

1. The Plumbing Contractor shall furnish and install all motors, starters, pushbuttons for local and remote control, controllers, pressure switches, aquastats or similar items together with all appurtenances, accessories and control wiring required to operate the equipment furnished under their respective sections of the contract, which is necessary to perform the operating functions as specified, shown on the drawings or as otherwise required.

    a) Exceptions:
        1) Motor starters for plumbing equipment provided in motor control centers shall be furnished under Division 26.

2. Under Division 26, power wiring shall be provided up to a termination point consisting of a junction box, trough, starter or disconnect switch. Under Division 26, line side terminations shall be provided. Wiring from the termination point to the mechanical equipment, including final connections and proper rotation, shall be provided under Division 22.

3. The Plumbing contractor shall confirm all electrical characteristics of Plumbing equipment with the Electrical Contractor prior to ordering. If procurement requirements necessitate a change in the electrical characteristics of any motor or equipment being furnished under the Plumbing Contract, the respective contractor shall first obtain approval of such changes from the Professional. This same Contractor shall also be responsible for all necessary arrangements and shall pay all costs, if any, for all required changes to the Electrical Contract.

B. Electrical Equipment by Others:

1. All electrical equipment furnished and installed under contracts other than the Electrical Contract shall be furnished with full complement of control equipment, control wiring, conduit and all other items necessary for satisfactory operation.

1.3 QUALITY ASSURANCE

A. Coordination with Electrical Work: Wherever possible, match manufacturers and types of electrical devices required under plumbing work with similar elements of electrical work specified in Division-26 sections. Comply with applicable requirements of Division-26 sections for electrical work of this section which is not otherwise specified. Refer to Section 220500 on requirements for product uniformity.

B. Standards: For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology herein. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for each type of separate motor, starters, and other electrical devices required for mechanical work. Include electrical characteristics, ratings, list of application and general locations.

B. Wiring Diagrams: After the contractor has placed orders for all materials and equipment, they shall prepare complete wiring and control diagrams for all equipment included in this contract.

1. Identity of terminals shall agree with those used by manufacturer of equipment.
2. A minimum number of copies of these wiring diagrams as required by respective contractors shall be submitted to the Professional for approval. One (1) copy shall be retained by Architect and one (1) by Engineer for record purposes.
3. In approving diagrams, the Professional assumes no responsibility for correctness of terminal identification.

C. Maintenance Data: Submit operation and maintenance data for each type of electrical device. Include this data in Maintenance Manual in accordance with requirements of Section 22 05 00.

PART 2 PRODUCTS

2.1 MOTORS

A. General: Provide electric motors for driving the plumbing equipment. Motors shall be of proper power, construction and speed to suit the specified makes of equipment. If other makes of equipment are accepted, the proper adjustment of motor speed and power must be included without additional cost. Submit drawings for review before the equipment is purchased.

B. Motor Characteristics: Except where more stringent requirements are indicated, and except where mechanical equipment cannot be obtained with fully complying motor, comply with the following requirements for motors of mechanical work.

C. Temperature Rating: Rated for 40°C environment with maximum 50°C temperature rise for continuous duty at full load (Class A Insulation). Where normal operating temperature will exceed this rating, provide Class B, F or H insulation as required.

D. Starting Capability: Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hours for manually controlled motors.

1. Fan motors shall be capable of accelerating their respective fans from 0 revolutions per minute to design or synchronous revolutions per minute within a maximum of 10 seconds. Submit to the Engineer for review curves which plot time versus revolutions per minute for the particular motor and fan combination.

E. Phases and Current Characteristics: Provide squirrel-cage induction polyphase motors for 1/2 hp and larger, and provide capacitor-start single-phase motors for 1/3 hp and smaller, except 1/6 hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division-26 sections, and with individual equipment requirements specified in other Division-22 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

F. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.

1. Coordinate the NEMA type of each motor with the torque and inertia load of the equipment served, and the inrush characteristics of the motor with the starter selection, so that all items furnished constitute a properly related package. No motor shall operate in the service factor range.

G. Motor Construction: Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque motors and accessories shall comply with NEMA Standards.

1. Frames NEMA No. 48

2. Bearings: Ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is normally inaccessible for regular maintenance.

   a. Where belt drives and other drives produce lateral and axial thrust, in motor, provide bearings designed to resist thrust loading. Refer to individual sections of Division 22 for fractional-hp light-duty motors where sleeve-type bearings are permitted.

3. Enclosure Type: Except as otherwise indicated, provide TEFC motors. Provide totally enclosed fan cooled (TEFC) weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 22 for other enclosure requirements.

4. Overload Protection: Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.

5. Noise Rating: Provide "Quiet" rating on motors, guaranteed to fulfil the specified requirements without producing any objectionable sound audible outside of machine rooms and which prohibits maintaining room NC levels as specified.

6. Efficiency: In accordance with IEEE Standard 112, test method B and NEMA Standards Publication MG1-2006.

   a. Motors of less than 1 horsepower shall be industry “standard” efficiency motors.
   b. Motors 1 horsepower or greater shall be “Premium Efficiency” as defined by energy efficiency levels mandated by the Energy Policy Act of 1992 in accordance with NEMA Publication MG 1-2006, Table 12-12, Full Load Efficiency for NEMA Premium Efficiency Motors.

      1) Motor nameplates shall be labeled with a Department of Energy approved code including the motor manufacturer’s specific compliance number issued by DOE. Each motor nameplate shall also display the NEMA nominal efficiency.

   c. All motors supplied with variable speed drives shall be inverter ready.

H. Name Plate: Provide metal nameplate on each motor, indicating full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

I. Acceptable Manufacturer: Subject to compliance with requirements provide motors for mechanical equipment by one of the following: Except where item of mechanical equipment (which otherwise complies with requirements) must be integrally equipped with motor produced by another manufacturer:

1. Baldor Electric Co.
2. Eaton Corp.
3. General Electrical Co.
4. Lincoln Electric Co.
5. Magne Tek
6. Marathon Electric Mfg. Corp.
7. Reliance Electric Co.
8. Westinghouse Electric Corp.

2.2 ELECTRICAL DEVICES AND WIRING

A. Motor Connections: Provide flexible-conduit motor connections except where plug-in electrical cords are specifically indicated. Comply with applicable provisions of Division-26 sections for wiring materials and wiring devices. Refer to individual equipment sections for special high-voltage (600 volts and over) and star-delta connected motor requirements.

2.3 MOTOR STARTERS AND SAFETY DISCONNECT SWITCHES

A. All motor starters and safety switches provided by Plumbing Contractor shall be in accordance with all requirements of Division 26. Provide NEMA-type enclosure consistent with environment in which starters will be mounted. Provide size of starter recommended by motor and/or equipment manufacturer for applicable protection and start-up condition; refer to equipment schedules for basic load requirements. Provide Hand/Off/Auto switch.

1. Manual Switches: Provide molded plastic manual switch with pilot light for motors ½ hp and smaller, except where interlock or automatic operation is indicated. Include overload trip assembly, one per phase.
2. Combination Magnetic Starters: Provide combination magnetic starters with circuit breaker disconnect for motors ¾ hp and larger, and for smaller motors where interlock or automatic operations is indicated.
3. Magnetic motor starters: Same as above without circuit breaker disconnect where disconnecting means is provided by others.
4. Safety Disconnect Switches: Where motor starters are part of the Plumbing packaged equipment and a separate safety disconnect is required, furnish in accordance with the requirements of Division 26.

2.4 EMERGENCY STOP SWITCHES (ESS)

A. GENERAL: Where indicated, provide emergency stop switches in accordance with the following:

1. 1-3/8” diameter red mushroom push button, twist to reset, single gang coverplate. Contacts as required.

2. Hinged clear acrylic protective cover.

3. Engraved nameplate fastened to wall above switch. Refer to drawings for nameplate nomenclature.

2.5 EQUIPMENT FABRICATION

A. General: Fabricate plumbing equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives, arranged for lubrication and similar running-maintenance without removal of guards, in accordance with OSHA Standards.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, securely anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws, except motors of 1/3 hp and less may be secured with Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Each motor shall be factory wired to a junction box mounted on the motor or on the driven piece of equipment to facilitate single point field power connection under Division 26.

C. The Plumbing Contractor shall install starters and wiring devices at locations indicated, securely supported and anchored, and in accordance with manufacturer's installation instructions and the National Electric Code. Locate for proper operational access, including for visibility and safety.

D. Check overload relay heaters with motor nameplate full load current. Change heaters per manufacturer's recommendation if not correctly rated at no cost to Institution.

E. Investigate and correct cause of motors operating above full load rating instead of increasing overload relay trip setting.

3.2 RACEWAYS

A. All power and control wiring by Plumbing Contractor shall be in raceways complying with Division 26.

3.3 COORDINATION

A. After the contractor receives the engineer's and approval, they shall then deliver the required minimum number of copies of the approved wiring diagram to the electrical contractor.

B. The contractor shall render whatever assistance is required by the electrical contractor in making connections to control devices furnished by the contractor.

END OF SECTION 220503

SECTION 220700 PLUMBING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Piping insulation.

B. Jackets and accessories.

1.2 REFERENCES:

A. Requirements for references and standards.

B. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]).

D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.

E. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cemen.

F. ASTM C240 - Standard Test Methods of Testing Cellular Glass Insulation Block.

G. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

H. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

I. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

J. ASTM C547 - Standard Specification for Mineral Fiber Preformed Pipe Insulation.

K. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.

L. ASTM C578 - Standard Specification for Preformed, Cellular Polystyrene Thermal Insulation.

M. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

N. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

O. ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

P. ASTM D1667 - Standard Specification for Flexible Cellular Materials--Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).

Q. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

R. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.

S. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

T. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

U. NAIMA National Insulation Standards.

V. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

W. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS FOR REVIEW:

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.4 SUBMITTALS FOR INFORMATION:

A. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE:

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years experience.

1.6 REGULATORY REQUIREMENTS:

A. Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255 or UL 723.

1.7 DELIVERY, STORAGE, AND PROTECTION:

A. Material and Equipment: Transport, handle, store, and protect products.

B. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.8 ENVIRONMENTAL REQUIREMENTS:

A. Maintain conditions required by manufacturers of each product.

PART 2 - PRODUCTS

2.1 TYPE A GLASS FIBER:

A. Insulation: ASTM C547 and ASTM C795; rigid molded or semi flexible, noncombustible.
   1. 'K' value: ASTM C177, 0.24 Btu-in/hr-ft2-F at 75 degrees F.
   2. Maximum service temperature: 850degrees F.
   3. Maximum moisture absorption: 0.2 percent by volume.

2.2 TYPE B: - Not Used.

2.3 TYPE C: - Not Used.

2.4 TYPE D: - Not Used.

2.5 TYPE E: - Not Used.

2.6 TYPE F: - Not Used.

2.7 TYPE G: - CELLULAR FORM:

A. Insulation: ASTM C534; flexible, unicellular elastomeric, molded slit tubing, or sheet.
   1. 'K' value: ASTM C177; 0.27 at 75 degrees F.
   2. Minimum service temperature: -40 degrees F.
   3. Maximum service temperature: 220 degrees F.
   4. Maximum moisture absorption: ASTM D1056; 3.0 percent by volume (Pipe), 6.0 (sheet).
   5. Moisture vapor transmission: ASTM E96; 0.17 perm-inches.
   6. Butt joints: Neoprene contact adhesive

2.8 INSULATION JACKETS:

A. General: Provide Manufacturer's standard white craft jacket wherever type "A" insulation is specified in all concealed locations or unless indicated elsewhere in this specification. At the contractors option, provide PVC plastic fitting covers wherever white kraft or canvas jackets are specified. Jackets are not required for insulation type "G", except where exposed to the weather.

B. PVC Plastic:
   1. Jacket: ASTM D1784, one-piece molded type fitting covers and sheet material, white color.
      a. Minimum service temperature: 0 degrees F.
      b. Maximum service temperature: 150degrees F.
      c. Moisture vapor transmission: ASTM E96; 0.002 perm-inches.
      d. Thickness: 15 mil.
      e. Connections: Brush on welding adhesive or pressure sensitive color matching vinyl tape.

C. Vapor Barrier Jacket: ASTM C921, White kraft paper with glass fiber yarn, bonded to aluminized film. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.

D. Vapor Barrier Lap Adhesive.

   1. Neoprene contact adhesive or combination lagging and sizing type depending on application

2.9 ACCEPTABLE MANUFACTURERS:

A. Insulating materials:
   1. Type "A" – Schuller, Knauf, or Owens Corning
   2. Type "G" – Rubatex or Armstrong Armaflex

B. Coatings, Adhesives, Cements and Mastics: Foster, Childers, 3M, Marathon, Pittsburgh Corning, Vimasco.

C. Jackets and fitting covers:

1. Jackets other than metal: Ceel-Co, Proto Corp., Exact-Fit, or Speedline

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign materials removed.

3.2 INSTALLATION:

A. Refer to manufacturer's instructions for application of all materials.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 160 degrees F or less, do not insulate flanges and unions at equipment, and bevel and seal ends of insulation.

G. For hot piping conveying fluids over 160, insulate flanges and unions at equipment.

H. Glass fiber insulated pipes conveying fluids above ambient temperature:
1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:
1. Application: All piping.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert material: Hydrous calcium silicate blocks or other heavy density insulating material suitable for the planned temperature range.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to plan details.

K. Omitted PLUMBING Insulation: Do not insulate exposed chrome plated piping, air chambers, trap primers, strainers, check valves, unions, balancing or isolation valves. Do not insulate lavatory or sink wastes or supplies unless scheduled as handicapped with pre-fabricated wrap system.

L. Provide cellular foam insulation as a substitute for Types “A” only where approved by the engineer

3.3 SCHEDULES:

A. Plumbing Piping.

Insulation Thickness
In Inches for Pipe Sizes in Inches (Jacket per specification)

SERVICE	TYPE	1 and less	1 ¼ to 2	2 ½ to 5	≥ 6
Domestic Hot Water (including return)	A or G	1	1	1	-
Domestic Cold Water	A or G	½	½	½	-
Traps where called for to be insulated.	A or G	1	1	1	-

END OF SECTION 220700

SECTION 221000 PLUMBING PIPING

PART 1 - GENERAL

1.1 WORK SECTION INCLUDED:

A. Interior domestic water piping systems
B. Interior and exterior sanitary drainage piping systems
C. Sleeves and floor plates
D. Supports, hangers, inserts and fasteners
E. Valves
F. Pipe identification
G. Valve tags

1.2 QUALITY CONTROL

A. All pipe and fittings shall be manufactured in the United States of America and shall bear a USA mill stamp.

PART 2 - PRODUCT

2.1 DOMESTIC WATER PIPING

A. Above grade:

Piping:	Type "L" hard temper copper tubing, ASTM B88
Fittings:	Cast bronze or wrought copper solder end fittings, ANSI B16.18, ANSI B16.22
Solder:	95-5 tin-antimony solder, ASTM B32 for sizes up to 1 1/4-inch
Brazing solder:	ASTM B260 for sizes 1 1/2-inch and larger

B. Below grade (1/2-inch through 2-1/2-inches):

Piping:	Type "K" copper tubing, ASTM B88
Fittings:	Cast bronze or wrought copper solder end fittings, ANSI B16.18, ANSI B16.22
Solder:	95-5 tin-antimony solder, ASTM B32 for sizes up to and including 1 1/4-inch
Brazing solder:	ASTM B260 for sizes 1 1/2-inch and larger

B. Below grade (3-inches and larger):

Piping:	Ductile Iron pressure pipe Class 52, ANSI A21.51/AWWA C151 with ANSI A21.4/AWWA C104 cement lining
Fittings:	Mechanical joint ANSI A21.10/AWWA C110 with gaskets

2.2 SANITARY WASTE AND VENT

A. Sanitary waste and vent piping:

Piping:	Schedule 40 PVC DWV, Solid Core, ASTM D2665.
Fittings:	Socket solvent weld, ASTM D2665.

2.3 DRAIN PIPING (Relief Valve and Water Heater Drain Pan Piping):

Piping:	SDR11, CPVC, ASTM D2846
Fittings:	socket type fittings, solvent weld joints. ASTM D2846
Solvent:	Less than 510 g/L VOC, ASTM 493

2.4 SLEEVES AND FLOOR PLATES

A. Sleeves in finished areas shall be provided with chrome plated escutcheons sized to fit securely at the pipe or pipe insulation and shall cover the sleeve and penetration opening.

B. Sleeves in Non-Rated Construction:

1. Interior Partitions - New Construction:

   24-gauge galvanized sheet metal sleeve with mineral wool insulation packing between sleeve and piping/piping insulation.

2. Floor - New Construction:

   Schedule 40 black steel sleeve with retaining collar welded to sleeve with mineral wool insulation packing between sleeve and piping/piping insulation.

3. Slab on Grade:

   Schedule 40 black steel sleeve with retaining collar welded to sleeve, and expandable modular seals with molded rubber interlocking sections.

   Seal Manufacturers:

   Thunderline Corporation
   Metraflex Company
   GPT Link-Seal

4. Below Grade Foundation Wall - New Construction:

   Schedule 40 black steel sleeve with retaining collar welded to sleeve and expandable modular seals with molded rubber interlocking sections.

   Seal Manufacturers:

   Thunderline Corporation

Metraflex Company
GPT Link-Seal

5. Sleeves in Rated Construction:
Piping which penetrates rated construction shall be provided with UL listed through penetration assemblies. Assemblies shall provide protection of the through penetration equal to or greater than the construction rating. Assemblies shall be selected after determining all characteristics of the assembly including piping material and size, construction type, rating (in hours) of the required construction and fill, sleeve, void or cavity materials. All voids between sleeve and wall or between sleeve and carrier pipe shall be filled with UL listed fireproofing material of rating equivalent to or exceeding that of the adjacent construction.

Fireproofing material manufacturers:
IPC
3M Dow Corning
Nelson

2.5 SUPPORTS, HANGERS, INSERTS AND FASTENERS

A. Provide all steel required for support of pipes and equipment other than steel shown on Structural Engineer's drawings.

B. All hanger materials including clevis hangers, rods, inserts, clamps, stanchions, brackets, shall have a factory applied finish of electro-plated zinc, unless noted otherwise.

C. Hangers, clamps and supports for use on uninsulated copper piping shall be provided with inserts to isolate the copper piping from the hanger. Inserts shall be made of felt or plastic and shall be as manufactured by the hanger manufacturer.

D. Insulated piping shall be provided with insulation shields.

E. Hanger Materials:

1. Horizontal Sanitary, Waste, Vent Piping and Storm water Piping:
   a. 3 inch and smaller:

B-Line	B3100
Grinnell (Anvil)	260
PHD	450

   b. 4 inch and larger:

B-Line	B3102
Grinnell (Anvil)	590
PHD	420

2. Horizontal Domestic Water Piping:
   a. 2 inch and smaller:

B-Line	B3100
Grinnell (Anvil)	260
PHD	450

   b. 2-1/2 inch and larger:

B-Line	B3100
Grinnell (Anvil)	260
PHD	450

3. AWWA piping:

B-Line	B3102
Grinnell (Anvil)	590
PHD	420

4. Insulation Shields:

B-Line	B3155
Grinnell (Anvil)	168
PHD	160

F. Vertical Piping (Riser Clamps):

1. Copper Pipe (copper plated with plastic coated formed portion.):

B-Line	B3373CT
Grinnell (Anvil)	CT-121C
PHD	554

2. Steel Pipe:

B-Line	B3373
Grinnell	261
PHD	550

G. Connectors:

3. Beam Clamps:

B-Line	B3033, B3050, B3291-B3297
Grinnell (Anvil)	88, 133, 134 or 292S.
PHD	360, 620

4. Concrete inserts:

B-Line	B2500, B3014
Grinnell (Anvil)	282, 285

PHD	950

5. Welded beam attachments:

B-Line	B3083
Grinnell (Anvil)	66
PHD	900

6. Piping adjacent to walls or steel columns, brackets:

B-Line	
Grinnell (Anvil)	No. 194, 195, or 199, depending on weight to be supported.
PHD	

7. Base supports:

B-Line	
Grinnell (Anvil)	Figure No. 259, or 264.
PHD	

H. Hanger Rods:

Hanger rod,	Figure No. 140.
Continuous threaded rod,	Figure No. 146.
Eye Rods,	Figure No. 248.

I. Trapeze Hangers:

Direct Mounting Hangers:	Figure No. 46.

2.6 VALVES

A. All valves shall be products regularly produced for the specified service and rating in accordance with the manufacturer's catalog or engineering data. All valves shall be marked with the manufacturer's name or trademark. The recommended service pressure and the size, by letters and figures, cast or stamped on the body of the valve.

B. All valves shall be standard 200 pounds per square inch (psi) WOG minimum unless otherwise specified. Valve ends shall be compatible with the piping system served.

C. Gate valves for water main service shall be iron body, bronze mounted, tapered seat non-rising stem, O-ring packing. AWWA C500, 200 psi working pressure. Open counterclockwise. Mechanical joint valve ends shall conform to AWWA C111. Valves shall be of a design that requires no more than fifty (50) lbs. pull on the standard valve wrench to provide positive shutoff against rated working pressure.

D. All flanges shall be plain faced, smooth finished and shall conform in dimensions and drilling to the American Cast Iron Flange Standard Class l25 (Bl6.l-48).

E. Ring gaskets l/6 inch thick shall be used with all flanged valves. Gaskets shall be Cranite, Garlock. Coat one (l) side of gasket with graphite and oil, thread lubricant before installing.

F. Domestic Hot and Cold Water Valves:

1. Ball Valves:

2-1/2-inch and Smaller: 600 psi WOG, full port, two piece, bronze body, chrome plated steel ball and stem NIBCO T-585-70; Apollo 70-100; Stockham S-216BR-R-T, threaded end; Nibco S-585-70; Apollo 70-200; Stockham S216BR-R-S, sweat ends.

2. Check Valves (Swing Type):

2-inch and Smaller: Bronze body, bronze disk for general service. Sweat ends shall be Milwaukee #1509; Stockham #B-309; Powell #1825. Threaded ends shall be Milwaukee #509; Stockham #B931; Powell #578.

PART 3 - EXECUTION

3.1 GENERAL

A. All materials, equipment and accessories specified in this section shall be installed in strict accordance with the manufacturers' recommendations.

3.2 PIPING INSTALLATION

A. All piping in finished areas shall be run concealed except where specifically shown otherwise. All piping shall be installed as required to suit space available in building structure, above suspended ceilings, and other locations found necessary for installation. Install piping as high as possible.

B. The Contractor shall not install any piping that will interfere with any lights, openings, doors, windows, ductwork, equipment, and existing or special conditions. Headroom in front of openings, doors, or windows shall not be less than the top of the opening. Provide all piping offsets necessary to avoid interference with other work. Piping offsets shall include all devices and assemblies necessary to accommodate the change in direction of the piping.

C. All piping shall run straight with no more couplings and joints than necessary, shall be grouped wherever practical and shall be carefully installed to provide for proper alignment slope and expansion.

D. Pipes carrying fluids shall not be installed in transformer vaults, electrical equipment rooms, elevator hoist-way or equipment rooms, or similar areas having a collection of electrical equipment. Pipes shall not be installed over, around, in front of, in back of, or directly below, electrical controls, panels, switches, terminals, boxes, or similar electrical equipment, refer to the NEC code for clearance requirements.

E. All piping shall be installed with not less than 2 inches between finish covering of pipe and all other work or piping.

F. All piping shall have shut-off valves at all branch connections to mains.

G. Reduction in sizes of pipes shall be made with reducing fittings. Bushings will not be permitted.

H. The Contractor shall perform excavation of the subgrade where required for the installation of the work, including that for piping and piping enclosures. The backfill shall be stabilized by hand or pneumatic tamping as directed by the Professional and shall be returned to the original subgrade level. Piping shall not be run in cinder fill unless protected by a concrete envelope of 2 inches minimum thickness on all sides of pipe.

I. Bullhead connections in any piping service are prohibited.

J. All screwed joints shall be made with a non-corrosive, non-hardening compound or teflon tape applied on the male thread only. All compounds must be approved for the pipe on which they are used. Pipe ends shall be reamed or filed out to size of bore and all chips and cuttings removed. Ends of pipe must be cut square so as to seat in the bottom of the recess in drainage fittings. In making joints in chromium plated brass pipe no more than one thread shall remain exposed when joint is completed. Caulking of screwed joints is not permitted. Pipe joint cement and paint will be permitted only on external threads.

K. All soldered joints shall be made with fittings specified. Copper tube and brass pipe, valves, unions, flanges, fittings, and connections shall be joined by means of lead-free solder. Ends of all pipe and inside surfaces of fittings shall be cleaned, burnished and tinned before solder is applied. All joints in tubing 2 inches and larger shall be tinned and then soldered with a circular type flame torch. Pull joints, saddle type joints, and "T-Drill" type connections are prohibited.

L. Drainage Piping:

1. All sewer piping shall be set true to line and even slope using grade boards and targets or grade lines in accordance with ASTM C12, "Recommended Practice for Laying Sewer Pipe". Horizontal sanitary and storm piping shall be installed to pitch towards drain points. Minimum pitch shall be 1/8 inch per foot for

sanitary piping 4 inch and larger. Pitch for sanitary piping smaller than 4 inch shall be 1/4 inch per foot minimum. Minimum pitch shall be 1/4 inch per foot for storm piping 4 inch and larger. Roof drains serving emergency overflow roof drains shall be sloped at a minimum of 1/2 inch per foot. Minimum pipe size below grade shall be 2 inch for all drainage systems.

2. All changes in pipe size of soil, waste, and drain lines shall be made with reducing fittings or reducers. Changes in direction, where space permits, shall be made with long sweep bends, Y-fittings, and one-eighth (1/8) or one-sixteenth (1/16) bends, or combination "Y" and 1/8 bends.

3. Cleanouts shall be furnished installed on horizontal runs and at the base of stacks for all soil, waste, drain, and rain conductor lines. A cleanout shall be installed at every change of direction of greater than 45 degrees. Cleanouts shall be installed not more than 50 feet apart for piping 4 inch size and smaller. Cleanouts shall be installed no more than 100 feet apart for piping larger than 4 inch. Cleanouts on horizontal runs above ground, including crawl spaces, shall be cast brass plugs in wye fittings. Cleanouts at the base of each vertical stack shall be cast brass plugs in wye fittings. Cleanouts on buried or concealed lines shall be brought flush with grade or floor level. Cleanouts in walls shall be brought flush with finished face of the wall. Cleanouts on underground lines shall be made with wye and 45 degree fittings. Terminal (Yard) cleanouts on underground lines shall have a concrete cradle bearing block set against undisturbed earth. 45 degree fittings shall be set against concrete cradle to prevent separation or misalignment of joints. Cleanout plugs shall be full size for pipe up to and including 4 inch diameter and not less than 4 inch diameter for larger size pipe.

4. Water closet floor flanges shall be cast iron, screwed or caulked, not less than 1/4 inch thick; not less than 2 inches caulking depth. Bolted with approved gasket between closet bowl and flange. Closet screws shall be of brass. The use of commercial putty or plaster for setting closet bowls is prohibited.

M. Pressure Piping:

1. Branch piping shall be as indicated, but shall be a minimum 3/4 inch in nominal size with the last ten feet to each 1/2 inch outlet fixture a minimum of 1/2 inch in nominal size.

2. Each water piping system within the building shall be properly arranged and graded to low points where the entire system can be emptied through a drain. Install manual air vents at all high points in the system.

3. Drain Valves - Furnish and install a 1/2" ball valve with female hose connection at all low points of the domestic water piping systems. The hose bibb shall be located so as to be accessible and easily operable, and so that a hose can be connected to the outlet.

4. Outside water piping shall be so graded and arranged that water can be drained from the underground piping through drains installed in the building served. The drains shall be the same size and type specified for interior piping.

N. Equipment Piping:

1. Provide Isolation valves in supply and return to each item of equipment such as pumps, tanks, automatic valves, and similar items. Valves shall be suitably located to isolate each unit to facilitate maintenance or removal of all equipment and apparatus. Valves shall be flanged or have a union installed between valve and equipment.

2. Provide all piping from backflow preventers, relief valves, or other drainage to spill over open sightdrains, floor drains, or other trapped acceptable discharge points, and terminate with plain end (unthreaded) pipe.

3. Provide thermometer wells and pressure gauge wells for specified thermometers and gauges, and at the inlet and outlet connection of each piece of equipment specified in this contract.

O. Electrolysis control:

1. All copper piping installed under this Contract shall be installed so that the piping will not touch or come in contact with ferrous metals. Where copper tubing or piping for fittings is anchored, guided, supported, secured, or may come in contact with ferrous metal, an insulating nonconductor spacer, similar to rubber or fiber, shall be installed to assure prevention of electrolysis.

2. When copper tubing or piping is connected to ferrous piping or equipment, connections shall be made with approved dielectric fittings.

3.3 SLEEVES AND FLOOR PLATES

A. Sleeves shall be provided for all pipes passing through walls, partitions, floor slabs or roof slabs. Sleeves shall be cut flush with wall, floor or ceiling surfaces except that sleeves through waterproofed roof or floor slabs shall extend one inch (1") above the finished surface. Sleeves shall be sufficient size to allow a sealable annular space between the sleeve and the pipe or between the sleeve and the pipe insulation. All exposed piping passing through floors, walls or ceiling shall be provided with a chrome escutcheon plate securely fastened around the pipe. The annular space around the pipe in non-water-proof sleeves shall be filled with penetration sealant and smoothed out flush with all surface.

B. All pipe, tube, conduit, or similar through-penetrations of all fire rated walls, floor-ceiling, or roof-ceiling assemblies shall be provided with a fire stopping system to achieve a tight seal that will maintain the fire resistant rating of the assembly

containing the through-penetration. Fire stopping system may be sealant or mechanical type.

3.4 PROTECTION AGAINST PHYSICAL DAMAGE

A. In concealed locations, where piping, other that cast-iron or galvanized steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1¼-inches from the nearest edge of the member, the pipe shall be protected by shield plates. Protective shield plates shall be a minimum of 1/16-inch thick steel, shall cover the area of the pipe where the member is notched or bored and shall extend a minimum of 2-inches above sole plates and below top plates.

3.5 SUPPORTS, HANGERS, INSERTS AND FASTENERS

A. The Contractor shall furnish and install all supports, hangers, inserts and fasteners for the items incidental to the work in the construction of the project. Supports and hangers shall be provided to suit specific conditions for the type of construction. The method adopted shall be subject to the approval of the Professional.

B. Supports shall secure pipes in place, prevent swaying and vibration, maintain required grading, provide free expansion and shall have a neat appearance. Supports shall be selected for strength and service and installed in a manner which will not stress building construction. Supports shall be selected for safety factor of five (5) to one (1) for gross weight of piping system including fluid and installation.

C. Where support is from concrete construction, take care not to weaken concrete or penetrate waterproofing. Only use inserts for suspending hangers from concrete slabs. Use beam clamps for suspending hangers from building steel. Do not hang one pipe from another. Do not use perforated band iron, wire or chain as hangers. Do not use vertical expansion shields. Do not hang from joist bridging.

D. Fastenings required in masonry walls, bolts shall be galvanized U-bolts set in the construction during erection.

E. Where several pipes can be installed in parallel at the same elevation, provide trapeze hangers. Trapeze hangers shall be suspended by means of rods or angles. Brace trapeze hangers to prevent motion due to expansion and contraction of pipe. Support individual pipes by hangers or rollers.

F. All vertical piping shall be supported at each floor level. Riser clamps at exposed locations shall be of such design as to avoid creating a hazardous or unsightly condition and stay within space limitations. Pipe supports are required at the base of all vertical risers and shall be of riser size. In the case of waste and vent risers for plumbing system, support the fitting at the base of the riser independently from the adjacent pipe joint support. Support all piping from above as it changes from horizontal to vertical.

G. Where hanger rods are longer than 18 inches, provide lateral bracing at every fourth hanger. Do not support piping by wire, rope wood or other makeshift device. Provide additional steel supports where building construction does not permit the hanger spacing as specified in the schedules. Location and details shall be submitted to the Professional for review.

H. Where loading exceeds the safe allowable limit for any single insert, then multiple inserts shall be installed spaced no less than 12 inches on centers. The multiple inserts shall be connected with suitable size steel angles and locking bolts.

I. Where inserts in new construction have been omitted or are required in existing construction, the fastening shall be accomplished by means of approved lead sheathed expansion bolts. Wood plugs shall not be used. Expansion shields in precast concrete slabs shall not be loaded more than one-half (1/2) their maximum design capacity and never more than 200 pounds per bolt. Where bolts used with lead expansion bolts are spaced closer than one foot centers, the multiple bolts shall be connected with suitable size steel angles and locking bolts or with single bolts extending through the slab above with a bearing plate. Where finished floors occur, the welded plate and rod shall be recessed in the slab, finished in an approved manner.

J. Where fastenings are required in steel stud, wire lath or other non-masonry construction, a "J" hook and holding lock washer and nut shall be used which shall fasten to the opposite stud edge to which the item will abut. If the location of the fastening is not a steel stud, a structural steel shape shall be fastened to the wall with bolt and holding nut, with the fastening extension through the wall. The use of toggle bolts will not be permitted.

K. Where roofing construction is supported by structural steel members or bar joist, support piping systems, devices, and equipment from structural steel members or secondary fabricated supports.

L. Where concrete floor construction is supported by structural steel members or bar joist, support of piping, ductwork, devices and equipment may be from metal tabs integral with the metal deck system to the maximum of the equivalent of a 10 foot length of 4 inch Schedule 40 section of pipe filled with water or 6 inch cast iron drainage pipe. Where tabs projecting down from the metal deck system are not available, inserts for concrete deck construction shall be installed. Inserts in poured concrete slabs shall be iron, fabricated galvanized iron or steel of the type to receive a machine bolt head or nut after installation and shall permit adjustment of this bolt in one horizontal direction.

M. Where poured concrete roof and floor construction is supported by concrete members, support piping systems, devices, and equipment from roof to floor construction by use of concrete slab inserts.

N. Inserts in poured concrete slabs shall be iron or fabricated galvanized iron or steel of the type to receive a machine bolt head or nut after installation and shall permit

adjustment of this bolt in one (1) horizontal direction. Inserts shall be accurately located before the concrete is poured.

O. Piping, tanks and equipment shall be adequately supported either by suspension from the construction above or by means of struts or brackets to the construction below or to the side.

P. Before drilling any concrete for attachments, installer shall carefully check concrete drawings and shop drawings and shall locate drilled holes to avoid reinforcing by at least 1 inch.

3.6 HANGER AND ROD SCHEDULE

	Steel Pipe		Copper Tubing	
Nominal Diameter	Spacing	Rod Size	Spacing	Rod Size
Inches	Feet	Inches	Feet	Inches
1/2	5	3/8	5	3/8
3/4	6	3/8	6	3/8
1-1/4	6	3/8	7	3/8
1-1/2	10	3/8	8	3/8
2	10	3/8	9	3/8

Where unusual concentrated loads of valves and fittings occur, closer spacing shall be required. Submit specific cases for review and comment.

Where piping changes direction, supports shall be placed in each direction adjacent to joints and no more than 12 inches from the joint.

3.7 VALVES

A. Valves shall be installed at each riser, branch to equipment, at each group of fixtures, at each fixture not equipped with stop valves, and where shown on the drawings. Valves shall be installed with stems at or above the horizontal plane.

B. Where supplies to individual fixtures occur in base cabinets, or in other places where copper tubing supplies are used stops shall be solder end.

3.8 PAINTING

A. All painting shall be done in a careful, neat and workmanlike manner, with particular care being exercised to protect building equipment and finishes. All surfaces shall be thoroughly cleaned or rust, scale, dirt, grease, dust, and like items, and sanded so as to provide a bond for new paint. All painted surfaces under this Contract shall be finished in an acceptable manner.

B. Insulation, galvanized piping, and copper piping in crawl spaces, in sump pits, inaccessible pipe spaces, and above ceilings shall not be painted.

C. All uninsulated non-galvanized steel piping, supports, hangers and other iron and steel work installed under this Contract, shall be painted with two (2) coats of rust preventative paint. Copper drain piping need not be painted.

3.9 PIPING IDENTIFICATION

A. All piping shall be identified with stenciling or self-adhesive pipe markers complying with ASME A13.1. Identification shall specify piping system and direction of flow. Piping shall be identified at a minimum of 10' intervals and at every transition, wall penetration and branch connections. Identification and lettering shall be oriented to be easily observable from normal viewing locations. Piping systems that are stenciled shall utilize the following for system identification:

Piping System	Stencil Identification
Domestic Cold Water	DCW
Domestic Hot Water	DHW
Sanitary Sewer	SS
Sanitary Vent	V

B. Equipment, controls, valves, and other devices needed service, adjustments or maintenance but located in concealed spaces and above the ceiling shall be marked on surfaces visible from floor. A ½" color tape label placed on ceiling grid at approximate location of the device shall be acceptable. Selected marking scheme shall accompany a schedule or legend which copy shall be included in O&M manual and posted in mechanical room.

3.10 TESTS

A. Drain and vent piping shall be tested by filling to roof level with water. Test may be in parts provided all sections are tested at least once.

B. Water system shall be tested to 100 psi. Either water or air is acceptable. Test may be in parts provided all sections are tested at least once.

C. All tests shall be for a minimum of 1 hour.

D. All tests shall be at a time when weather conditions allow for visual inspection.

E. All tests shall be compliant with section 312, North Carolina Plumbing Code, except where more stringent requirements are herein.

3.11 DISINFECTION OF POTABLE WATER SYSTEMS

A. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.

B. The system or part thereof shall be filled with a water/ chlorine solution containing not less than 50 parts per million (50 mg/L) of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing not less than 200 parts per million (200 mg/L) of chlorine and allowed to stand for 3 hours.

C. Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.

D. The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.

E. Certification as required by local authority shall be provided.

END OF SECTION 221000

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work in this Section includes the following:

1. Cleanouts
2. Floor Drains
3. Water Hammer Arrestors

1.2 SUBMITTALS

A. The Contractor shall submit manufacturer's catalog data for the following:

1. Cleanouts
2. Floor Drains
3. Water Hammer Arrestors

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Finished Floor Cleanouts: Coated cast-iron body, taper thread bronze plug, scoriated secured nickel bronze top. Cleanout shall have adjustable housing.

1. Acceptable Manufacturers: Josam, J. R. Smith, Wade, Zurn, Watts Drainage.

B. Carpeted Area Cleanouts: Coated cast-iron body, taper thread bronze plug, scoriated secured nickel bronze top with carpet marker. Cleanout shall have adjustable housing.

1. Acceptable Manufacturers: Josam, J. R. Smith, Wade, Zurn, Watts Drainage.

C. Tile Floors Cleanouts: Coated cast-iron body, taper thread bronze plug, with square top recessed for tile. Cleanout shall have adjustable housing.

1. Acceptable Manufacturers: Josam, J. R. Smith, Wade, Zurn, Watts Drainage.

D. Wall Cleanouts: Round stainless steel wall access cover with center screw and recessed bronze tapped plug. Provide cleanout with threaded coated cast iron cleanout tee.

1. Acceptable Manufacturers: Josam, J. R. Smith, Wade, Zurn, Watts Drainage.

E. Exposed Piping Cleanouts: Recessed bronze tapped plug in threaded cast-iron cleanout tee.

1. Acceptable Manufacturers: Josam, J. R. Smith, Wade, Zurn, Watts Drainage.

2.2 FLOOR DRAINS

A. Acceptable Manufacturers: Josam, J. R. Smith, Wade, Zurn, Watts Drainage.

2.3 WATER HAMMER ARRESTORS

A. Water Hammer Arrestors shall be of Type "L", Type "K" copper or stainless steel bellows or plunger type construction conforming to PDI WH-201.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All materials, equipment and accessories shall be installed in strict accordance with manufacturer's recommendations.

B. Provide isolation valves for all fixtures, equipment, and accessories.

END OF SECTION 221005

SECTION 223000 PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Expansion Tank.

B. Electric Storage Water Heater

PART 2 - PRODUCTS

2.1 NATURAL GAS FIRED INSTANTANEOUS DOMESTIC WATER HEATER

A. Provide condensing and non condensing and capacities as indicated in schedule.

B. Provide copper heat exchanger.

C. Provide stainless steel casing.

D. Provide electronic ignition.

E. Provide master controller to link together the number of units shown on the plans, including any future units indicated.

F. Provide ASME rated temperature and pressure relief valve.

G. Manufacturers

1. Noritz
2. Rinnai
3. Rheem

H. Provide a 5 year warrantee for unit in commercial use.

2.2 ELECTRIC STORAGE WATER HEATER

A. Provide electric fired storage water heater.

B. Provide foam insulation.

C. The water heater shall comply with the requirements of the latest edition of ASHRAE 90.1 standard.

D. Provide ASME rated temperature and pressure relief valve.

E. Manufacturers

1. Lochinvar
2. A.O. Smith
3. State
4. Rheem/ Rudd
5. PVI

F. Provide a 3 year non-prorated warrantee against tank failure from date of final project acceptance.

2.3 PRESSURE TANK

A. Bladder type prepressurized pressure tank.

B. Welded steel constructed, tested and stamped with Section VIII, Division 1 of the ASME Code for 125 psi and air precharged.

C. Tank shall have a heavy duty butyl bladder, minimum thickness of 0.10 inches with ANSI/NSF61 Code approvals.

D. Tank shall be supported by steel legs or integral ring mount base for vertical installation.

E. Tank shall be painted with one shop coat or red oxide primer.

F. Available Manufacturers

1. Amtrol Wee-x-trol
2. Wessels
3. Hansen

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment, piping and accessories shall be installed in strict accordance with manufacturer's requirements.

B. Drain leave as is purge from all pumps shall be extended to within 4 inches of floor drain.

C. Sump pumps shall be vented through roof. Each pump discharge line shall be provided with a full flow gate valve and swing check valve.

D. Provide isolation valves for all equipment, and accessories.

E. Unions shall be provided adjacent to all equipment or wherever necessary to facilitate the removal of equipment for repair of replacement. Unions for copper tubing up to and including 2" diameter shall be brass ground joint with socket ends for solder. Unions for copper tubing 2-1/2" in diameter and over shall be standard brass flanges with socket ends for solder. Flanges to be drilled for ASA Standard 125 lbs. flanges and so stamped. No lip type unions or long screws will be permitted. The Contractor shall furnish and install all structural steel angles, channels, etc. necessary to properly support all fixtures and equipment to the satisfaction of the Professional.

F. Furnish and install isolation valves at the cold water and hot water supply tappings and an AGA/ASME pressure and temperature relief valve for each water heater.

G. The drawings are diagrammatic in showing plumbing equipment layout. Variations in differing manufacturer's piping arrangements and physical equipment size require careful layout by the Contractor. The Contractor shall coordinate his layout so as to provide adequate clearances to allow for maintenance and inspection. In particular, equipment supports shall not obstruct floor drains or utility trench access and piping shall be installed to allow sufficient vertical clearance above treatment tanks.

END OF SECTION 223000

SECTION 224000 PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Sinks

B. Water Closets

C. Urinals

D. Lavatories

E. Mop Receptors

PART 2 - PRODUCTS

2.1 GENERAL:

A. All fixtures shall be furnished complete with traps, faucets, wastes, supplies with stops, etc., as required. All exposed metal parts shall be chromium plated.

B. Fixtures and equipment shall be those of reputable manufacturers and shall be new.

C. All fixtures and equipment of similar types shall be of the same manufacturer unless indicated otherwise on the drawings or specified herein.

D. Fixtures shall be mounted at mounting heights as indicated.

E. If fixtures and equipment indicated in the Contract Documents are not currently manufactured, the manufacturer's current equivalent to the indicated fixtures and equipment shall be provided at no additional cost, subject to review and acceptance by the Professional.

F. All materials used on plumbing systems shall comply with the following lead ban requirements:
   1. Solders with lead content exceeding 0.2% (two-tenths of a percent) are prohibited. Brass and bronze materials containing 0.25% (25 hundredths of a percent) or greater lead are prohibited. All lead content shall be per ANSI/NSF 372.
   2. All materials shall be compliant with the 2011 “Reduction of Lead in Drinking Water Act”.
   3. Components that are specifically exempted in the Act, such as water closets, urinals, flush valves and shower valves need not comply.

2.2 PLUMBING FIXTURES:

A. Acceptable Manufacturers: American Standard, Kohler, Zurn, Crane, Elkay, Halsey Taylor, Haws, Just.

B. Refer to the drawings for specific fixture selections.

2.3 FAUCETS:

A. Acceptable Manufacturers: Delta, Chicago, T&S Brass, Moen.

B. Refer to the drawings for specific fixture selections.

2.4 FLUSH VALVES:

A. Acceptable Manufacturers: American Standard, Hydrotech, Zurn, Sloan.

B. Refer to the drawings for specific fixture selections.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Fixtures and equipment shall be installed in a neat and workmanlike manner and in accordance with the manufacturer's recommendations.

B. All wall mounted lavatories shall be provided with carriers and supports suitable to the type of construction wherein they are located. Wall mounted water closets shall be supported by chair carriers.

C. All fixtures and equipment must be protected against damage during the progress of construction. Upon completion of construction, all fixtures and equipment must be thoroughly cleaned and left in perfect working order. All piping and accessories having polished, plated or finished surfaces shall be protected to prevent scarring or other damage and protect the finish against damage.

D. Provide isolation valves for all fixtures, equipment, and accessories.

E. All fixture supplies and waste lines shall be routed to the wall unless construction or fixture type requires that they be routed to floor. All supplies through walls shall be provided with angle stops. All supplies through floors shall be provided with straight stops. Unions shall be provided adjacent to all equipment or wherever necessary to facilitate the removal of equipment for repair of replacement. Unions for copper tubing up to and including 2 inch diameter shall be brass ground joint with socket ends for solder. Unions for copper tubing 2-1/2 inches in diameter and over shall be standard brass flanges with socket ends for solder. Flanges to be drilled for ASA Standard 125 pounds flanges and so stamped. No lip type unions or long screws will

be permitted. The Contractor shall furnish and install all structural steel angles, channels, etc. necessary to properly support all fixtures and equipment to the satisfaction of the Professional.

F. Mop receptors drains shall be sized for the outlet pipe size shown on drawings and shall be equipped with P-traps. The Contractor shall be responsible for proper height setting and leveling of drains.

G. Apply a bead of waterproof caulking around the edge of surface mounted plumbing fixture to mask any irregularities between the fixture and wall finish. Color of caulk shall match the fixture color.

3.2 MOUNTING HEIGHTS:

A. Plumbing fixture mounting heights shall conform to that detailed on the Architectural drawings. The Contractor shall coordinate the mounting height of all fixtures with the mounting heights indicated. Mounting heights for barrier free fixtures shall meet the requirements of the ADA Accessibility Guidelines, and shall apply unless superseded by more stringent State or local code.

END OF SECTION 224000

SECTION 230000 MECHANICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. General: This section specifies several categories of provisions of mechanical work, including: 1) Certain adaptive expansions of requirements specified in Division 1, as uniquely applicable to mechanical work, 2) General performance requirements within the mechanical work as a whole and 3) General work to be performed as mechanical work, because of its close association with mechanical work. This section applies to all subsequent Division 23 sections.

B. Heating, Ventilating, Air Conditioning and Refrigeration work shall include all material and labor to furnish and install all the HVAC systems as indicated on the M-series drawings and the mechanical specifications.

C. Contractor - The person or organization awarded the contract for construction services. In the case of a construction project administered as a multiple-prime contract, the term shall be further defined as the Contractor holding a prime contract for Mechanical construction work. Any reference to “contractor” or “subcontractor” shall be superseded by the actual contractual arrangement used on the project.

D. The term “Mechanical Contractor is used interchangeably with the term “Contractor”.

E. All start-up and testing and balancing shall be complete. Coordination between the TAB and mechanical contractors will be mandatory and the responsibility of each.

F. All bidders shall visit the site prior to submitting a bid. Any existing condition which should be obvious to an experienced bidder shall be deemed to be included in the bid. Failure of any bidder to visit the site shall not relieve them of this responsibility.

1.2 QUALITY ASSURANCE:

A. Workers shall be thoroughly experienced and fully capable of installing assigned work. Work shall be in accordance with the best standard practice of the trade. Work that is not of good quality will require removal and reinstallation at no additional expense to Owner.

B. Provide complete operational mechanical systems with facilities and services to requirements described, in accordance with applicable codes and statutes.

C. Drawings are diagrammatic and approximately to scale. The contract documents establish scope, material and quality, and are not detailed installation instructions. The Contractor shall be responsible to prepare all necessary coordination and shop drawings to completely and correctly install systems and/or make field

modifications necessary resulting from a failure to do so, at no additional cost to the contract.

D. Provide labor and materials required to install, test and place into operation the mechanical systems. Provide additional labor and materials for modifications required to correct job conflicts resulting from a failure to coordinate between trades, at no additional cost to contract.

E. Certain terms such as "shall, provide, install, complete, start-up" are occasionally not used in some parts of these specifications. This does not indicate that the items shall be less than completely installed or that systems shall be less than complete.

F. Protect all materials and equipment from damage during storage at the Site and throughout the construction period. In the event of damage prior to final inspections, the Contractor shall repair or replace damaged items as determined by the Architect or Engineer, at no cost to the Owner.

G. Install all equipment and appurtenances in strict accordance with the manufacturer's requirements and recommendations.

H. Working pressure of piping, fittings, valves, equipment and accessories in piping systems shall be of a pressure rating equal to or greater than the maximum working pressure of the system and/or the test pressure to which it will be subjected.

I. All welders shall be certified by the Welding Bureau of the Mechanical Contractors Association of America for the appropriate service, and shall perform all welding in accordance with Welding Bureau's procedures and the ASA Code for pipe welding.

1.3 DEFINITIONS:

A. By other Trades: Shall mean by persons or parties who are not anticipated to be the contractor for this trade working together with the Prime Contractor. In this context the words "by other trades" shall not be interpreted to mean not included in the overall contract, unless specifically noted as not in contract (NIC).

B. Concealed: Embedded in masonry or other construction, installed behind wall furring, above ceilings, in crawl spaces, in shafts or otherwise not visible.

C. Contractor: As used in this Division of the specification refers to the Mechanical Contractor unless specifically noted otherwise.

D. Ductwork: All air distribution, recirculation and exhaust ducts, whether of sheet metal or other material, and includes all connections, hanger, supports, damper controls, insulation, accessories, fire and smoke control devices, and appurtenances necessary for and incidental to a complete system.

E. Exposed: Not concealed.

F. Furnish: Purchase and deliver to the project site complete with every necessary appurtenance and for installation.

G. Install: Unload at the delivery point and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project.

H. Piping: Pipe, fittings, flanges, valves, controls, hangers, supports, traps, drains, gauges, insulation, vents and items customarily required in connection with the transfer of fluids.

I. Provide: Furnish and install complete ready for use.

1.4 INTERPRETATION OF CONTRACT DOCUMENTS:

A. This section of the specifications and related drawings describe general provisions applicable to every section of Division 23.

B. Attention is directed to Instructions to Bidders and General Conditions, which are binding in their entirety on this portion of the work and in particular to paragraphs concerning materials, workmanship and substitutions.

C. Provide all materials called for in these specifications and accompanying drawings and provide the apparatus complete in every respect. Anything called for in the specifications and not shown on the drawings, or shown on the drawings and not called for in the specifications must be provided.

D. Mention in these specifications, indications and reasonable implications on drawings, whereby articles, materials, operation or methods related to execution of the mechanical work are noted, specified, drawn or described, thereby requires execution of each such item of work and provision of all labor, materials, equipment and appurtenances required for execution thereof.

E. Particular attention is directed to the drawings and other contract documents for information pertaining to required items or work which are related to and usually associated with the work of this Division of the specifications, but which are to be provided as part of the work of other Divisions of the specifications.

F. Drawings show arrangements of system desired and shall be followed as closely as practical. Because of the small scale of the drawings not all offsets and bends can be shown and these shall be provided as required, to fully complete the intent of plans. Verify and check all measurements in the field. Should conditions and substitutions of equipment necessitate a rearrangement, prepare and submit for review, scaled drawings of such rearrangement before beginning work.

G. No exclusions from, or limitations in, the language used in the drawings or specifications shall be interpreted as meaning that the appurtenance or accessories necessary to complete any required system or item of equipment are to be omitted.

H. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed, in accordance with the intent diagrammatically expressed on the drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded. When abbreviations appear on the drawings or specification in lower case letter with or without periods, their meanings shall be the same as stated above.

I. Certain details appear on the drawings that are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not make unnecessary the field coordination for the indicated work.

J. Information as to the general construction shall be derived from structural and architectural drawings and specifications only.

K. The use of words in the singular shall be considered as limited where other indications denote that more than one item is referred to.

L. Submission of a proposal and ultimate acceptance of an agreement or contract for execution of this section of work will be construed as evidence that the Prime Contractor, Subcontractor and Vendor has carefully read and accepts all conditions set forth in each Division under specification Divisions titled “Instruction to Bidders” and Division 1, “General Condition”, insofar as such conditions may affect both the bidding for and execution of this section or work.

1.5 DELINEATION OF WORK:

A. The “Division of Work:” as shown on the drawings, is a recommended division of work as an aid to Contractors and Subcontractors for bidding and performance of the overall prime contract. This or any other reference to the Mechanical Contractor or any Subcontractor shall in no way be intended to interfere with or relieve the Prime Contractor as to his overall responsibility.

B. Division 23 contractors are required to supply all necessary supervision and coordination of information to any others who are performing work to accommodate Division 23 installations. Where the Division 23 contractors are required to install items which they do not purchase, they shall include for such items:

1. The coordination of their delivery.
2. Their unloading from delivery trucks driven in to any designated point on the property line at grade level.
3. Their safe handling and field storage up to the time of permanent placement in the project.
4. The correction of any damage, defacement or corrosion to which they may have been subjected.
5. Their field assembly and internal connection as may be necessary for their

proper operation.

6. Their mounting in place including the purchase and installation of all dunnage, supporting members, fastenings necessary to adapt them to architectural and structural conditions.
7. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building systems.

C. Items that are to be installed but not purchased as part of the work of Division 23 shall be carefully examined upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the work will be considered only if presented in writing within one week of the date of delivery of the project of the items in question. The work under Division 23 shall include all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

1.6 MECHANICAL CODES, STANDARDS & REGULATIONS:

A. General: All work shall comply with the current governing codes, ordinances and regulations of all National, State and Local authorities having jurisdiction. The requirements of the following governing bodies, codes and standards are included by reference and shall have the same force and affect as if printed here in full (in addition to specific applications specified by individual work sections of these specifications):

1. ADA: Air Diffusion Council.
2. AMCA: Air Moving and Conditioning Association, Inc.
3. ANSI: American National Standards Institute
4. ANSI Pressure Piping Standards (B31-Series).
5. ARI: American Refrigeration Institute
6. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers
7. ASHRAE 15, Safety Code for Mech. Refrig. (ANSI B9.1).
8. ASME: American Society of Mechanical Engineers
9. ASME Boiler and Pressure Vessel Code
10. ASTM: American Society of Testing and Materials
11. AWS Standards for Welding.
12. IBR: Institute of Boiler and Radiator Manufacturers
13. MSS: Manufacturers Standardization Society
14. North Carolina Department of Labor
    a. The Uniform Boiler and Pressure Vessel Act – current edition
15. North Carolina State Building Code.
    a. General Construction
    b. Plumbing
    c. Mechanical
    d. Energy
    e. Fire Code
16. NEMA: National Electrical Manufacturer’s Association

17. NFPA 45: Standard on Fire Protection for Laboratorial Using Chemicals
18. NFPA 70 National Electrical Code.
19. OSHA: Occupational Safety and Health Administration
20. SMACNA: Sheet Metal and Air Conditioning Contractors National Association, Inc.

B. Include all items of labor and materials required to comply with such standards and codes. Where quantity, sizes or other requirements indicated on the drawings or herein specified are in excess of the standard or code requirements, the specifications or drawings, respectively, shall govern.

C. Should contractor become aware of any change in plans or specifications required to comply with governing regulations, the Contractor is to notify the Professional at least 10 days prior to the bid date.

1.7 PERMITS AND FEES:

A. The contractor shall arrange for, obtain and pay for all permits, certificates, tests, inspections, agency approvals, etc. and pay all fees levied by the authorities and having jurisdiction over the work performed under this contract. Provide copies of all required permits, certificates, inspections and agency approvals to the owner. Contractor shall submit to the appropriate Regulatory Agencies all items necessary to obtain all required permits and to perform all tests and inspections.

B. Contractor shall pay royalties or fees required in connection with the use of any patented devices and systems.

1.8 VERIFICATION OF DIMENSIONS AND LOCATIONS:

A. The Contractor shall visit the premises and thoroughly familiarize themselves with all details of the work, working conditions, verify all dimensions in the field, advise the Architect/Engineer of any discrepancy, and submit shop drawings of any significant changes affecting other work he proposes to make, in quadruplicate for approval, before starting the work.

B. The location of duct, pipe, fixture, equipment and appurtenances for existing facilities are shown on plans to indicate the extent of work required. Exact condition shall be field verified.

1.9 PRODUCT SUBMITTALS:

A. General: Refer to the Division 1 sections for general requirements concerning work-related submittals. In addition to those general requirements, the following are required for Division 23 submittals. Failure to comply with these requirements may result in rejection without further review.
   1. Manufacturer or Vendor terms and conditions of sale are strictly between Vendor and Contractor. Approval of submittal data shall not be construed as approval of terms and conditions.

By providing submittals to the contractor to be forwarded to the engineer for review, the equipment vendor is acknowledging review of the contract documents and installation details, and that the submitted product is suitable for application in the manner indicated in the contract documents. Upon request, and at no additional charge, the equipment vendor will provide to the engineer a letter from the manufacturer stating the product has been applied in accordance with manufacturer's recommendations.

B. Product Data, Shop Drawings and Samples: After checking and verifying all field measurements, the Contractor shall submit to the Engineer for review, in accordance with the accepted schedule of shop drawings submissions, copies of all product data, shop drawings and samples, which shall have been checked by and stamped with the approval of the Contractor and identified as the Engineer may require. The data shown on the shop drawings will be complete with respect to dimensions, design criteria, materials of construction and the like to enable the Engineer to review the information as required.

1. The Contractor shall review each submittal in detail. The work described in shop drawing submission shall be carefully checked for clearances (including those required or recommended for maintenance and servicing), field conditions, maintenance of architectural conditions and proper coordination with other trades on the job. If it is determined to be correct, the Contractor shall place an approval stamp on each copy; approval stamp shall be filed in with the date on which the items is checked and the checker's name. The Contractor's approval stamp certifies that submittals and related job conditions have been checked and that conflicts do not exist. Any job conflicts arising from the contractor's failure to fully complete these responsibilities shall be corrected as directed by the Professional at no additional cost to the contract. Drawings which the Contractor finds are incomplete or incorrect shall be returned to the source without being forwarded to the Professional. Drawings which do not contain the signed Contractor's stamp may be returned unchecked to the Contractor. Return of unchecked submittals and any delays in construction it may cause, will not be considered cause for any extensions or delays in construction by the Contractor.
2. Shop drawings shall be submitted well in advance of field requirements to allow ample time for checking. Submittals shall be complete and contain required detailed information. Shop drawings with multiple parts shall be submitted as a package.
3. Include with each submittal a permanent cover sheet for identification. Provide the following information on the cover sheet for proper processing and recording of action taken. A sample cover sheet can be made available by the Engineer for reproduction and use for each submittal.
    a. Project name;
    b. name and address of Professional;
    c. name and address of Contractor;
    d. name and address of supplier;
    e. Sequential submittal number (e.g. FP-1, M-1, P-1, P-2, P-3, etc.); resubmittals shall be designated with the same submittal number but noted as a resubmittal (e.g. FP-1R, M-1R, P-1R, P-2R, P-3R, etc.);

f. name of manufacturer;
g. number and title of appropriate specification section, drawing number identifying symbol, and detail references, as appropriate.
h. similar definitive information as necessary.
i. space for the Contractor's review and approval markings
j. space for the Professional "Action" marking

4. Submit materials and equipment by manufacturer, trade name and model number. Include copies of applicable brochure or catalogue material. Do not assume applicable catalogues are available in the Professional's office. Maintenance and operating manuals are not suitable substitutes for shop drawings.
5. Identify each sheet of printed submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information. Note specified features such as special tank linings, pump seals, materials or painting.
6. Include dimensional data for roughing in and installation, technical data sufficient to verify that equipment meets requirements of drawings and specifications. Include wiring, piping and service connection data, motor sizes complete with voltage ratings and schedules.
7. Installed materials and equipment shall meet specified requirements regardless of whether or not shop drawings are reviewed by the Professional.
8. Furnish all submittals for the items used in this project as listed in their related sections.
9. The Contractor shall also submit to the Engineer for review, with such promptness as to cause no delay in work, all samples required by the Contract Documents. All samples shall have been checked by and stamped with the approval of the Contractor, identified clearly as to material, manufacturer, any pertinent catalog numbers and the use for which intended.
10. At the time of each submission, the Contractor shall in writing call the Engineer's attention to any deviations that the shop drawings or sample may have from the requirements of the Contract Documents. Make specific mention of such difference in a letter of transmittal, with request for substitution, together with reasons for same.
11. The Engineer shall review with reasonable promptness shop drawings and samples, but their review shall be only for conformance with the design concept of the project and for compliance with the information given in the Contract documents.
12. No work requiring a shop drawing or sample submission shall be commenced until the submission has been reviewed by the Engineer. A copy of each shop drawing and each approved sample shall be kept in good order by the Contractor at the site and shall be available to the Engineer and other authorities having jurisdiction.
13. The Engineer's review and acceptance of submitted data or shop drawings for material equipment apparatus, devices, arrangement and layout shall not relieve Contractor from responsibility of furnishing the proper dimensions and weight, capacities, sizes, quantity, quality and installation details to efficiently perform the requirements and intent of the Contract. Approval shall not relieve the Contractor from responsibility for errors, omissions or

inadequacies of submitted data or shop drawings.

14. Upon final approval of shop drawings, the Contractor shall submit manufacturer's installation instructions to the Local Building Authority for all equipment and appliances at their request.
15. Upon final approval of shop drawings, the Contractor shall submit a record copy of all applicable items to the Balancing Agency.
16. If any components for which shop drawings have been approved is later found to not comply with those shop drawings contractor shall be responsible for all costs to address this, including but not limited to charges from the owner, engineer and other contractors.

1.10 SUBSTITUTIONS:

A. Follow requirements listed in the general provisions of the contract.

B. Submittals are not opportunities for gaining acceptance of substitutions. Where three or more manufacturers are specified by name or by catalog reference, Contractor shall select for use any of those so specified.

1. Should Contractor desire to substitute another manufacturer's equipment for one specified by name, the Contractor shall apply to the Engineer in writing no later than 10 days prior to bid opening for such permission. They shall provide supporting data and samples for Engineers consideration. No substitution shall be made for any material, article or process required under the contract unless approved by the Engineer.

C. Contract documents are based on materials and equipment specified. Approval by Professional of equipment submitted by the mechanical trade as equal to that specified does not relieve the mechanical trade of any responsibility.

D. Revisions required to adapt alternative shall be included in such proposals. No increase in the contract price will be considered to accommodate the use of the equipment other than that specified.

E. Wherever operating results such as quantity delivered, pressure obtained, or similar results are specified, or a definite manufacturer and size of apparatus is specified, for which such quantities are readily determinable, the manufacturer and size of apparatus that the Contractor has proposed using must conform substantially (in regard to the operating results) to the quantities specified or implied. This requirement shall also apply to important dimensions relating to operation of apparatus in coordination with the rest of the system, and to properly locating the apparatus in available space conditions.

F. Acceptance of substitutions for equipment specified shall be given only after receipt of complete and satisfactory performance data covering the complete range of operating conditions in tabular and graphical form. Furnish complete and satisfactory information relative to equipment dimensions, weight, etc. Acceptance of equipment specified or shown on the Drawings, or substitutions submitted for that specified or shown on the drawings, will be granted if such equipment, in the opinion of the Professional, conforms to the performance requirements, space conditions, weight requirements and quality requirements. Acceptance by the Professional as “equivalent” does not relieve the contractor(s) of any responsibility. Any additional construction and design costs incurred as a result of any accepted

substitution shall be borne by the Contractor.

1.11 TRADE PRODUCT SUBSTITUTION:

A. It is the intent of this specification that all qualified suppliers be provided a fair opportunity to bid work, regardless of whether they are named in the specification.

B. Where manufacturers are named it is to establish a general level of quality and features. Proposed substitutes must be equivalent to those named performance, sound, materials and means of construction, finishes, etc.

C. Should Contractor desire to substitute another manufacturer's equipment for one specified by name, the Contractor shall apply to the Engineer in writing no later than 10 days prior to bid opening for such permission. They shall provide supporting data and samples for Engineers consideration. No substitution shall be made for any material, article or process required under the contract unless approved by the Engineer.

1.12 REQUESTS FOR INFORMATION:

A. During the course of construction, the Contractors may find it necessary to request additional information. The Professional encourages written requests for information (RFI's) to clearly document the request. The response issued by the design Professional is an attempt to assist in the progress of construction. With a response, the design Professional is not conceding any deficiency of the design and is not assuming responsibility for means and methods. RFI's may not be used and asserted as an excuse for late submittal of shop drawings. The Contractor bears the responsibility to prioritize RFI's in the order in which it desires the professional to respond.

1.13 ALTERNATES:

A. Refer to Division 1 for Schedule of Alternates, if any.

B. Alternate amounts quoted on bid forms shall include any and all costs to coordinate related work among all disciplines and modify surrounding work as required to obtain complete and operational systems.

1.14 PROJECT/SITE CONDITIONS:

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. If conflicts arise, prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Professional before proceeding.

1.15 FUTURE PROVISIONS:

A. Where indicated on the Contract Documents there may be provisions for future work. Contractor shall carefully coordinate any associated work that could affect that future work. Future equipment space and working clearances shall be maintained by avoiding routing current mechanical systems through those areas. Where indications of “Capped For Future” are indicated, provide capped isolation valves in piping and for duct work provide dampers with capped ends, sealed with removable sealant.

1.16 OWNER FURNISHED PRODUCTS:

A. Certain products may be furnished to the site and paid for by Owner: Rough-ins and final connections shall be provided by the HVAC subcontract as required. Contractor shall fully coordinate requirements with Owner and/or Owner’s vendor.

1.17 INTERRUPTION OF SERVICES:

A. Occupancy: The work is to be performed in and around existing facilities that are occupied by the public as a place of business. The work shall be coordinated and scheduled with the Owner and/or Owner’s representatives to minimize any disruption to normal functions and occupancy of the facility.

B. The Contractor shall schedule their work to avoid any major interruption of any utility services.

C. Existing utilities serving facilities occupied and used by the Owner or others shall not be interrupted except when such interruptions have been authorized in writing by the Owner or the Professional. Interruptions shall occur only after an acceptable temporary utility services have been provided. The Contractor shall provide a minimum of ten (10) working days notice to the owner and receive notice to proceed before interrupting any utility.

PART 2 - PRODUCTS

2.1 MECHANICAL PRODUCT REQUIREMENTS:

A. Under the Base Bid, the specified equipment shall be used as the basis of the proposal.

B. Standard Products: Provide not less quality than manufacturer's standard products, as specified by their published product data. Notwithstanding the indication that a particular product/model number is acceptable, comply with the specified requirements. Do not assume that the available off-the-shelf conditions of a product comply with the requirements; as an example, a specific finish or color may be required. Where the specifications do list a specific model number for a

manufacturer, the construction of a product shall be equal to those models specifically listed.

C. Unencumbered Purchases: Wherever possible, avoid the purchase and use of products which are encumbered with questionable title transfers, patent rights, trade union restrictions, code compliance, non-listing as "approved products" for compliance with governing regulations, duties due, embargoes and similar possible encumbrances, claims, or seller's interest.

D. Purchasing: Do not purchase specific mechanical materials and equipment for the project until completion of submittals that might affect the purchase.

E. Conditions of Products: Unless noted otherwise, all equipment and materials required for installation under these specifications shall be new and without blemish or defect. Applicable equipment and materials to be listed by Underwriter's Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards, and as approved by local authorities having jurisdiction. All equipment shall bear labels attesting to Underwriters Laboratories approval where subject to Underwriters Laboratories label service. Where no specific indication as to the type or quality of material or equipment is indicated, a first-class standard article shall be furnished. All manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacturers of said equipment a minimum of three (3) years and, if so directed by the Engineer, be able to furnish proof of their ability to delivery this equipment by submitting affidavits supporting their claim. Comply with Division 1 requirements for exposure or visual display limitations against trademarks and manufacturer's names. Provide each product complete with trim, accessories, finish, guards, safety devices and similar components specified or recognized as integral parts of the product, or required by governing regulations.

F. Uniformity: Where multiple units of a generic product are required for the mechanical work (as specified in Division 23), provide identical products by the same manufacturer, without variations except for sizes and similar variations as indicated.

G. Limitations: Product/manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanges and grooved type), insulation, sheet metal, wire, steel bar stock, welding rods, solder, paint, fasteners, motors for unlike equipment units, and similar items used in the work, and except as otherwise indicated.

H. Product Compatibility Options: Where more than one product selection is specified, either generically, or proprietarily, selection is Purchaser's or Installer's option, except do not provide products which are not compatible with previously purchased or installed products which must interface with the adjacent selections. Provide mechanical adaptations as needed for the interfacing of selected products in the work.

I. Equipment Nameplates: Provide a permanent operational data nameplate on each item of power operated mechanical equipment, indicating the manufacturer’s name

and address, product name, model number, serial number, speed, capacity, power characteristics, labels of tested compliance, and similar essential operating data. Locate nameplates in easily-read locations; except where product is visually exposed in occupied areas of the building, locate nameplate in a concealed position (where possible) which is accessible for reading by service personnel. UL or other label, or other data that is die-stamped into the surface of the equipment shall be stamped in a location easily visible. The generic nameplate of a distributing agent will not be acceptable.

J. Except where more stringent requirements are indicated, comply with the product manufacturer's installation instructions and recommendations, including handling, anchorage, assembly, connections, clearances, cleaning, testing, charging, lubrication, adjustment, start-up test operation, and shut-down of operating equipment. Provide a copy of such instructions at the equipment during work on the equipment. Consult with manufacturer's technical representatives, who are recognized as the technical experts, for specific instructions on unique project conditions and unforeseen problems.

K. Statically and dynamically balance rotating equipment for minimum vibration and low operating noise level after installation is complete.

L. Pressure vessels and relief valves shall be selected, built and labeled in accordance with ASME. Obtain a certificate from the Inspector having jurisdiction showing such acceptance, and mount this certificate in a black frame under glass or laminated plastic adjacent to each pressure vessel and relief valves.

M. Where factory testing of equipment is required to ascertain performance and attendance by the Owner's representative is required to witness such test, associated travel costs and subsistence shall be borne by the Contractor.

N. No product containing any amount of any form of asbestos shall be installed on this project. Asbestos includes but is not limited to asbestiform varieties of chrysotile, crocidolite, anthoplyllite, tremolite or actinolite. The contractor shall furnish a letter to the Owner certifying that this requirement has been complied with prior to final payment.

PART 3 - EXECUTION

3.1 COORDINATION OF MECHANICAL WORK:

A. The HVAC contractor shall coordinate the HVAC work with the work of other trades to avoid installation conflicts. Conflicts arising from failure to coordinate shall be rectified by the contractors at no additional cost to the contract.

B. The mechanical drawings show the general arrangement of equipment, ductwork, piping and appurtenances. Follow these drawings as closely as the actual construction and the work of other trades will permit. Provide offsets, fittings, and accessories that may be required but not shown on the drawings. Investigate the site, structural and finish ground conditions affecting the work, and arrange the

work accordingly. Provide such work and accessories as may be required to meet such conditions.

C. Examine and compare the contract drawings and specifications with the drawings and specifications of other trades and work furnished by others not in contract (NIC), and report any discrepancies between them to the Professional and obtain from Professional written instructions for changes necessary in the mechanical work. Install and coordinate the mechanical work in cooperation with other related trades and work furnished by others (NIC). Before installation, make proper provisions to avoid interference.

D. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale similar to that of the design drawings, prepared on medium of the same size as contract drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work shall be clearly identified on the drawings as to the area to which it applies. Submit these drawings to the Professional for approval. At completion include a set of such drawings with each set of as-built drawings.

E. Certain materials will be provided by other trades. Coordinate the affected work with other trades. Examine the Contract Documents to ascertain these requirements. Consult with other trades regarding equipment so that, wherever possible, motors, motor controls, pumps and valves are of the same manufacturer.

F. Wherever work interconnects with work of other trades, coordinate with other trades to insure that they have the information necessary so that they may properly install the necessary connections and equipment. Identify items (valves, dampers, coils, etc.) requiring access in order that the ceiling trade will know where to install access doors and panels.

G. Coordination of Options and Substitutions: Where the contract documents permit the selection from several product options, and where it becomes necessary to authorize a substitution, do not proceed with purchasing until coordination of interface requirements has been checked and satisfactorily established.

H. Chases and Holes: Unless otherwise indicated, all piping and ductwork shall be run in concealed spaces between floor and ceilings or in chases. Ductwork and piping areas without ceilings shall be installed exposed and as high as practical. This Contractor shall be responsible for the location and size of holes required for pipe, ducts and other equipment and shall advise of chase spaces and holes required as building progresses. Failure to do so shall require this Contractor to provide or cut same.

I. Carefully check space requirements with other trades prior to installation to insure that material can be installed in the spaces allotted including finished suspended ceilings.

J. Structural Limitations: Do not cut structural framing, walls, floors, decks and other members, except with the Architect's or Engineer's written authorization. Authorization will be granted only where there is not another reasonable method of

completing the mechanical work, and where the proposed cutting clearly does not materially weaken the structure. Provide required supports and hangers for ductwork, piping and equipment, designed so as not to exceed allowable loading of structures.

K. Slots, chases, openings and recesses through floors, walls, ceilings, and roofs shall be provided by the various trades in their respective materials. Contractor shall properly locate such openings and be responsible for cutting and patching caused by the failure to do so.

L. All cutting and patching required for installation of Division 23 work shall be the responsibility of the associated Contractor(s), performed in accordance with all requirements indicated in Division 1.

1. Cutting Concrete: Where authorized, cut openings through concrete (for pipe penetrations and similar services) by core drilling or sawing. Do not cut by hammer driven chisel or drill, unless receiving special permission for specific cases.
2. Other Work: Do not endanger or damage other work through the procedures and processes of cutting to accommodate mechanical work. Review the proposed cutting with the Installer of the work to be cut, and comply with their recommendations to minimize damage. Where necessary, engage the original Installer or other specialists to execute the cutting in the recommended manner.
3. Patching: Where patching is required to restore other work, because of either cutting or damage inflicted during the installation of mechanical work, execute the patching in the manner recommended by the original Installer. Restore the other work in every respect, including the elimination of visual defects in exposed finishes, as judged by the Architect/Engineer and Owner.

M. Furnish and set sleeves for passage of pipes, ducts and conduits through structural masonry and concrete walls and floors and elsewhere as required for the proper protection of each pipe and duct passing through building surfaces. Coordinate locations of sleeves with General Contractor for proper scheduling and installation.

N. Install mechanical work to permit removal (without damage to other parts) of coils, heat exchanger plates and tube bundles, fan shafts and wheels, filters, belt guards, sheaves and drives, and other parts requiring periodic replacement or maintenance. Arrange pipes, ducts, and equipment to permit access to valves, gauges, starters, motors, and control components, and to clear the opening of swinging doors and access panels.

O. Sequence, coordinate and integrate the various elements of mechanical work so that the mechanical plant will perform as indicated and be in harmony with other work of the building. The Architect/Engineer will not supervise the coordination, which is the exclusive responsibility of the Contractor. Comply with the following requirements:

1. Install piping, ductwork and similar services straight and true, aligned with other work, close to walls and overhead structure (allowing for insulation), concealed where possible in occupied spaces, and out-of-the-way with

maximum passageway and headroom remaining in each space.

2. Arrange work to facilitate maintenance and repair or replacement of equipment without removal of relatively fixed building elements or other equipment. Locate services requiring maintenance on valves and similar units in front of services requiring less maintenance. Connect equipment for ease of disconnecting, with minimum of interference with other work.
3. Locate operating and control equipment and devices for easy access. Install access panels where units are concealed by finishes and similar work.
4. Integrate mechanical work with light fixtures and other work, so that required performances of each will be achieved.
5. Adjust location of pipes, ducts, panels, equipment, etc., to accommodate the work to prevent interference, both anticipated and encountered. Determine the exact route and location of each pipe and duct prior to fabrication
6. Right-of-Way: Piping systems that pitch have the right-of-way over those which do not pitch (e.g. drainage systems normally have right-of-way). Service lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.
7. Make offsets, transitions and changes in direction in pipes and ducts as required to maintain proper head room and pitch on sloping lines. Furnish and install air vents, drains, etc., as required to affect these offsets, transitions and changes in direction.
8. Obtain from Others furnishing products, materials or services not in contract, all necessary catalog cut sheets, rough-in requirements or any other such information as required to fully coordinate the services to support all such work by others. Costs that arise from not performing this coordination shall be borne by the Contractor.

P. Protective Drip Pans: Where indicated, and where mechanical work piping carrying liquids pass over electrical or electronic equipment which might be damaged by dripping liquids (leakage or condensation), install drip pans 2" deep, 16 gauge galvanized steel with rolled edges of adequate width and length to protect the electrical equipment. Pipe drainage from pan to nearest floor drain or similar suitable point of discharge, and terminate pipe as an open-sight drainage connection. Provide permanent support and anchorage to prevent displacement of drip pans. Drains shall be 3/4" copper unless noted otherwise. Locate drip pans as close to underside of piping as possible. Extend edges not less than 6" each side of piping and extend ends not less than 18": beyond equipment being protected.

Q. Electrical Work: Coordinate the mechanical work with electrical work, and interface properly with electrical service to mechanical equipment. In general, and except as otherwise indicated, install mechanical equipment ready for electrical connection.

1. Refer to Division 26 sections for electrical power connection of mechanical equipment, including disconnect switches.
2. Power Characteristics: Refer to the appropriate sections of Division 26 and the electrical drawings for the power characteristics available for the operation of each power driven item of mechanical equipment. Coordinate purchases to ensure uniform interface with electrical work.

R. Utility Coordination: Coordinate the connection of mechanical systems with exterior underground and overhead utilities and services. Comply with the requirements of governing regulations, franchised service companies and controlling agencies. It is the construction contractor's responsibility to mark and trace the lines using appropriate/suitable devices; i.e., metal detectors, pipe locators, etc.; or by having the appropriate utility company stake the lines. The contractor shall repair all utility systems he damages at no charge to the Owner. All repairs shall be performed to Owner's or the affected utilities' satisfaction. The contractor is responsible for all utility hook ups, disconnects and coordination with the appropriate agencies.

S. Seasonal Requirements: Adjust and coordinate the timing of mechanical system start-ups with seasonal variations, so that demonstration and testing of specified performance can be observed and recorded. Exercise proper care in off-season start-ups, to ensure that systems and equipment will not be damaged by the operation.

T. The HVAC Contractor shall be responsible to coordinate their work with the TAB and notify the TAB when each phase of the project is at 30, 60 and 90 percent complete, in order for TAB to provide the required field inspections.

U. The HVAC Contractor shall be responsible for ensuring that the HVAC systems, wiring, and controls are complete and operational and for providing written documentation as such to the Professional and the TAB prior to TAB being performed. The HVAC Contractor shall be responsible for any costs associated with additional services required to reschedule and/or redo TAB and punch list inspections resulting from the failure to perform said completed services.

3.2 CUTTING & PATCHING:

A. See Division 1 for Cutting and Patching requirements.

B. This Contractor must have an experienced Mechanic on the job before concrete floors, concrete or masonry walls are set in place, whose duty it shall be to locate the exact position of any and all sleeves and holes for the future installation of his pipe or duct work. This Contractor shall locate and size all openings required for his equipment in time to not delay the building construction.

C. If it becomes necessary to cut holes in concrete floors or concrete or other masonry walls, each subcontractor shall contact the Prime Contractor or their superintendent of Construction, and inform them of the position and size of the hole or other opening to be provided and the Prime Contractor shall determine how this will be done. Under no condition shall this Contractor make any cuts without permission from the Prime Contractor, nor shall he cut any green floors or walls.

D. This Contractor shall arrange proper openings in the building to admit their equipment. If it becomes necessary to cut any portion of the building to admit any equipment or install mechanical systems, this Contractor shall be responsible for cutting and patching. The portions cut must be restored to their former condition by this Contractor.

E. All cutting of structure shall be done using best method to minimize noise and cracking of structure. The method of cutting shall be approved by the Prime Contractor before work if started.

F. All drilled holes required for equipment or supports shall be done by this Contractor. Holes for piping shall be core drilled only.

3.3 ACCESS PANELS:

A. The Contractor shall furnish access doors to the General Contractor for installation in ceilings, walls, partitions and floors for access to valves, dampers, equipment, etc. and all appurtenances.

B. Access panels shall be of sufficient size to permit removal or access to equipment, except that the minimum size shall be 12-inches by 16-inches.

C. Access door locations shall be as determined by field conditions for optimum access to equipment, and shall be reviewed by the Professional before final installation, and shall be subject to the following:

1. Bottom of access doors shall not be lower than the top of the partition base, or a minimum of 6 inches above floor.

2. Tops and/or sides of access panels shall be a minimum of 6-inches from the ceiling or opening or from the edge of a wall return.

3. Access doors shall be suitable for installation in the finish material of the ceilings, walls, partitions and floors.

4. Frame and panel access doors in restrooms, kitchens and as indicated shall be stainless steel.

5. Access doors with UL Listing shall be provided in rated construction assemblies. Access doors shall be "B-Label" and shall have a UL one and one-half (1-1/2) hour rating at 250 degrees F rating for both door and frame. Maximum size shall be 20" x 20" or 400 square inches in area. Frame shall be sixteen (16) gauge minimum steel, panel shall be twenty (20) gauge minimum steel. Access doors shall be provided with a baked-on enamel finish (prime coat), continuous type hinge on one side, flush-face type lock with key operation and self-latching cylinder locks.

6. Access doors without UL label shall be provided in all non-rated construction assemblies: Frame shall be sixteen (16) gauge minimum steel, panel shall be fourteen (14) gauge minimum steel. Access doors shall be provided with a baked-on enamel finish (prime coat), concealed spring type hinges and flush-face type lock with key operation and self-latching cylinder locks. Door shall open 175 degrees (minimum).

7. All access doors shall be keyed alike.

3.4 STORAGE AND INSTALLATION OF EQUIPMENT AND MATERIALS:

A. Move and store products and materials in a manner that will protect them from damage, weather and entry of debris. The Contractor shall fully protect finished parts of the materials and equipment against damage from whatever cause during the progress of the work until final acceptance. Materials and equipment in storage and during construction shall be stored on elevated supports and covered on all sides with securely fastened protective rigid or flexible waterproof coverings in such a manner that nothing will be damaged or marred, and kept clean and dry. If items are damaged, do not install, but take immediate steps to obtain replacement or repair at no cost to Owner.

B. Piping shall be protected by storing it on elevated supports and capping the ends with suitable closure material to prevent dirt accumulation in the piping.

C. During construction cap all ductwork openings that could be exposed to dust, dirt and debris. Cap all piping installed vertically.

D. Periodically during construction and prior to Owner acceptance of the building, Contractor shall remove from the premises and dispose of all packing material and debris. All adjacent occupied areas shall be cleaned daily to remove dirt and debris resulting from this work.

E. If products and materials are specified or indicated on the drawings for a specific item or system, the Contractor shall use those products or materials. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of shop drawings.

F. Install materials and equipment with qualified trades people. Install all equipment and appurtenances in strict accordance with the manufacturer's instructions and recommendations.

G. Replace materials less than specified quality or as designated by Professional and relocate work incorrectly installed as determined by Professional.

H. All parts of the HVAC system shall be protected from entry of dust and other contaminants until all activities producing these contaminants are complete and all dust and debris has been removed. HVAC Contractor shall bear the responsibility to thoroughly clean all air handling equipment, interior surfaces of ductwork, terminal devices, air distribution devices and any other related mechanical equipment if any of these systems are contaminated due to inadequate protection during construction.

I. Do not use the HVAC system for temporary heat or cooling until all dust and other contaminant producing activities are complete and all dust and debris have been removed. Once all dust and other contaminant producing activities are complete and all dust and debris has been removed HVAC system may be used for temporary heating or cooling. Do not operate air systems until ductwork is complete, temporary filters are in place. At a minimum provide one-inch thick fiberglass filter media across the face of each return air opening prior to start of each air system during temporary system operation. HVAC Contractor shall bear

the responsibility to thoroughly clean all air handling equipment, interior surfaces of ductwork, terminal devices, air distribution devices and any other related mechanical equipment if any of these systems are contaminated due to use as for temporary heat.

J. Do not operate water systems until piping has been cleaned and startup strainers are in place.

K. Secure equipment with bolts, washers and locknuts of ample size to support equipment. Embedded anchor bolts shall have bottom plate and pipe sleeves. Grout all machinery set in concrete under the entire bearing surface. After grout has set, remove all wedges, shims and jack bolts and fill space with grout.

L. Valves, dampers operators, and access doors, shall be easily accessible, either in mechanical spaces or through access panels specified.

M. All equipment shall be thoroughly cleaned. All excess materials and all debris shall be removed from the site.

3.5 REVIEW OF WORK PROGRESS:

A. Prior to performing work, the Contractor shall carefully review and assess the installed Work of all other Trades and verify that all such Work is complete to the point where their installation may properly commence.

B. Verify that all equipment may be installed in accordance with all pertinent codes and regulations, the original design and the referenced standards. Schedule and obtain inspections of the AHJ, and contact Professional for site observations at appropriate times.

C. In the event of discrepancy, immediately notify the Architect/Engineer.

D. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

3.6 WELDING:

A. All welded piping shall be installed by Contractor using NCPWB or ASME Certified Welding Procedures. Welding shall comply with ANSI/ASME B31.1 and Section IX of the ASME Boiler and Pressure Code.

B. All welded piping shall be hydrostatically tested for pressure of 1-1/2 times the working pressure of the line, but not less than 150 psig. This hydrostatic test shall be witnessed by the Engineer.

C. Ten days before any welded work is to start, the Contractor shall furnish the Engineer copies of the welding procedures approved for the Contractor.

D. Before any welder is put to work in welding any piping for this job, the Engineer shall be furnished with duplicate copies of the certification of each welder. If, in the opinion of the Engineer, the welding is not done properly, a coupon shall be cut from field welds for inspection and/or the welder may be required to pass a recertification test. Costs of cutting the coupon shall be the responsibility of the Contractor. Also all welds shall be subject to non-destructive x-ray examination by Owner. In the event that defective work is found the Contractor will be responsible for all costs of non-destructive x-ray examination, including all remedial repair work and retesting of welding that is determined to be unsatisfactory.

E. No welding is to be covered with insulation or concealed until the welding has been approved by the Engineer as outlined above.

F. All welding operations shall be approved by the Engineer prior to beginning work. Extreme care shall be exercised to prevent damage to the existing buildings or building or surrounding contents during welding operations.

G. During welding of all piping, contractor shall use fire resistant or equal pad protection to prevent scorching or burning of existing floor and wall finishes, etc. Also, care shall be taken to eliminate sparks from dropping on existing furniture, equipment and flooring material. All damages created by welding flame or sparks shall be repaired to owner's satisfaction at contractor's expense.

3.7 PAINTING REQUIREMENTS:

A. Work buried in soil or encased in concrete or insulation need not be painted (except for protective coatings specified with the piping system).

B. Painting of work in finished areas will be done by others. However, this Contractor shall leave their work in proper condition and ready for painting by removing all dirt, grease, pipe dope and scale or other foreign material by wire-brushing or as required.

C. All insulation of piping and ductwork/insulation in equipment rooms shall be painted. After sizing pipe and insulation, it shall be painted with two (2) coats of chlorinated rubber base paint or other material as approved by the Architect. Exterior metal shall have two (2) coats of protective finish paint.

D. Except as indicated specifically otherwise herein, paint material shall be selected from materials for work under the Architectural Specifications.

E. Painting on all pipe and pipe insulation in equipment rooms shall be done by the Mechanical Contractor. Colors shall be selected from the Industry Standard for colors or those approved by the owner.

F. All equipment having factory applied finish shall have its surface restored to its original condition if the finish is marred during installation.

G. All exposed pipe and equipment in the equipment rooms which do not have factory finish, shall be painted two (2) coats of enamel, using material approved for work under the Architectural Specifications.

H. Paint accessible ferrous metal (does not include stainless steel), regardless of whether exposed or to be concealed behind ceilings, shaft enclosures or similar finish construction; exclusive of cast iron which is either concealed or set flush with floors or decks.

3.8 EXCAVATION, BACKFILLING AND COMPACTION:

1. The Contractor shall notify ULOCO prior to any work.

2. The Contractor shall perform all excavation, backfilling, compaction and necessary finishing for all piping, equipment, and accessories. Piping installation shall be in accordance with regulations and applicable State and Local codes.

3. The Contractor shall do all bracing, sheathing and shoring necessary to perform and protect excavations. The Contractor shall provide safety rails, lights, signs, etc. as necessary or required for safety or as required to conform to governing laws.

4. The Contractor shall provide, maintain, and operate pumping equipment of sufficient capacity to insure that all excavations and trenches are kept free of water at all times.

5. All surfaces of streets, walkways, seeded areas, or finished grade areas disturbed by the excavation shall be restored to their original condition and/or as indicated on the Project Documents.

6. Protect existing structures, utilities, sidewalks, pavements and other facilities not indicated for removal, from damage caused by settlement, lateral movement, undermining, washout and other hazards resulting from excavation operations.

7. Existing utility lines shown on the Project Documents do not indicate the exact in-place location of the lines. They do not show every pipe, fitting or appurtenance that may exist at the project site. The location and depth of all utilities shall be marked and recorded prior to any excavation. Should uncharted or incorrectly charted, existing piping or other utilities be uncovered during excavation, contact the Professional immediately for directions before proceeding further with work in this area. Cooperate with owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner.

8. If it becomes necessary to install any lines or equipment in locations other than those shown, the Professional's acceptance shall be obtained before starting the excavation.

9. The presence of explosives on the project site or the use of explosives in the execution of the work under this contract is not permitted.

10. Excavation:

    1. All mechanical excavation is unclassified.

    2. Trenches shall be dug to uniform width not less than 12-inches or more than 16-inches wider than the bell diameter of the piping. Trench sides shall be vertical, Except 4'-0"and deeper shall be excavated with sides sloped at a 45 degree angle beginning one foot above bottom of trench to prevent cave-ins. Other OSHA approved methods of preventing cave-ins may be employed by the contractor. Excavate trenches to depth indicated or required. Carry depth of trenches for piping as required to establish required slopes and invert elevations. Beyond building perimeter, keep bottom of trenches sufficiently below finished grade to protect against frost. The bottom of trenches shall be accurately graded to provide uniform and smooth flow throughout. Any over-excavation shall be backfilled with modified aggregate and thoroughly tamped.

    3. If trench excavation operations are performed when the atmospheric temperature is less than thirty-five (35) degrees Fahrenheit, the Contractor shall provide at his own expense cold weather protection as required to protect excavated trench bottoms from freezing. Under no circumstances will any pipe be permitted to be laid in a trench containing water or on a subgrade containing frost.

    4. Take up and re-lay pipe that is not laid true to required alignment or grade. Pipe that has had it's joints disturbed after laying shall be taken up and re-laid. Deviation from the required lines and grades will not be permitted unless approved by the Professional.

    5. Pipe Embedment - All pipe shall be laid on a First Class sand or granite dust screenings bedding. The bedding shall be a minimum depth of 6-inches (six) or 1/4 (one-fourth) the pipe diameter, whichever is greater. The bedding shall provide uniform longitudinal support to the pipe and shall be laid to provide the grade and line as shown on the drawings or as directed by the Professional. Compaction of embedment materials under the haunches and around the pipe to the springline of the pipe shall be by hand tamping. Final embedment for ferrous pipe materials shall extend from the springline of the pipe to a depth of 6-inches (minimum) above the top of the pipe. Final embedment for PVC pipe shall extend from the springline of the pipe to a depth of 18-inches (minimum) above the top of the pipe.

    6. Backfilling shall not be undertaken until all tests and inspections have been made. Use care to avoid damaging or displacing piping systems. All backfill material shall be free from cinders, ashes, refuse, organic material, boulders, rocks or stones, frozen soil, or other material that is

unsuitable. When the type of backfill material is not indicated on the plans or is not specified, the excavated material may be used, provided that such material consists of loam, clay, sand, gravel, or other material that is suitable for backfilling. From 1-foot above the top of the pipe to the subgrade of the pavement, material containing stones greater than 6-inches in their greatest dimension may not be used.

7. Backfilling shall be carefully performed and the original surface restored.

8. All trench backfill shall be brought to subgrade ready for base material or topsoil. After the initial aggregate backfill layer has been placed, refill remainder of the trench using backfill materials as follows:

   a. Lawns - Successive 6-inch layers of clean earth backfill material shall be deposited after initial aggregate backfill. This backfill shall consist of excavated material free from large clods of earth and stone. If large stones (greater than 6-inches) are encountered, remove stones from site and haul in clean earth backfill. The entire trench shall be uniformly tamped after each successive layer is deposited. Replace topsoil to approximate depth of existing as final refill operation and crown to such height as required by the Professional. Maintain crowned surface to the satisfaction of the Professional.

   b. Walks and Parking Areas - Clean earth backfill compacted in 6-inch layers to a point 8-inches below the adjacent existing surfaces. Refill the remaining 8-inches with compacted stone and replace walk or paving as required.

9. Thoroughly compact subgrade prior to the installation of 6-inches of First Class sand or granite dust screenings pipe bedding. Following satisfactory pipe laying and in-line structure installation, backfill trenches in no greater than 6 inch lifts to a height of at least 12-inches above the top of the outside barrel of the pipe with First Class sand or granite dust screenings pipe bedding.

10. All fill shall be compacted to ninety-five (95) percent. Each layer shall be compacted to the specified percent of maximum density obtained at optimum moisture content, in accordance with ASTM D1557, method D and ASTM D1556 sand cone method.

11. Compaction shall be accomplished by approved equipment suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

12. Thoroughly compact successive layers of backfill material with a vibrating compactor of a type and size satisfactory to the Professional.

Compacting of this backfill by puddling or jetting will not be permitted. Use mechanical tampers to compact backfill materials in trench refill operations to produce a density of backfill at the bottom of each layer of not less than 95-percent of the maximum density obtained at optimum moisture content.

13. All underground lines installed outside of building footprint shall have a magnetic type warning tape installed in the backfill 12" to 18" below grade.

3.9 MANUALS, REPORTS AND FORMS SUBMITTAL:

A. Submit specified number of operating and maintenance manuals, reports and forms to the A/E for review. Submittals shall be in strict compliance with specifications.

B. Submittals not approved or not submitted in proper format may be rejected and returned to Contractor. Contractor shall make necessary changes and resubmit until approved.

C. Submittals shall include all reports, forms and manuals referenced in these specifications.

3.10 GENERAL COMPLETION AND DEMONSTRATION:

A. All aspects of the work shall be completed and demonstrated to be operating correctly before project will be considered complete. The following results are expected:

1. All systems and controls shall be complete, tested and operational.

2. All start-up and testing and balancing shall be complete.

3. All equipment shall be thoroughly cleaned. All excess materials and all debris shall be removed from the site.

4. All walls, floors, ceilings and other surfaces marred or otherwise damaged as a result of execution of this contract shall be cleaned and repaired to the satisfaction of the Architect/Engineer and Owner.

3.11 MAINTENANCE OF LOCAL SERVICE ORGANIZATION:

A. The Contractor shall maintain sufficient forces to respond promptly to any system problems that occur during construction and during the warranty period. The Contractor shall provide the Owner and the Engineer with reliable and prompt means of contacting the Contractor. In the event that after an attempt to contact the Contractor, the Contractor does not respond appropriately to any problem, the Owner and/or Engineer will without further notice address the problem. All costs

associated with addressing the problem will be borne by the Contractor including all costs of the engineer and owner and including all risk of damage to equipment except that caused by gross negligence of others.

END OF SECTION 230000

SECTION 230503 ELECTRICAL REQUIREMENTS OF MECHANICAL SYSTEMS

PART 1 GENERAL REQUIREMENTS

1.1 SECTION INCLUDES

A. General: The contents of this section describe the division of work and product requirements for work normally recognized as electrical but required for mechanical work including, but not necessarily limited to:

1. Motors
2. Motor Starters
3. Power and Control Wiring
4. Emergency Stop Switches (ESS).

1.2 DIVISION OF WORK

A. This section delineates the division of electrical work between Division 23 and 26.

1. The HVAC Contractor shall furnish and install all motors, starters, pushbuttons for local and remote control, controllers, pressure switches, aquastats or similar items together with all appurtenances, accessories and control wiring required to operate the equipment furnished under their respective sections of the contract, which is necessary to perform the operating functions as specified, shown on the drawings or as otherwise required.

    a) Exceptions:

        1) Motor starters for mechanical equipment provided in motor control centers shall be furnished under Division 26.
        2) Duct smoke detectors shall be furnished and wired by Division 28, installed by Division 23. Fire alarm AHU shut down circuits shall be wired from the fire alarm control panel to a termination point, adjacent to the AHU control, under Division 28. AHU control wiring from the termination point to the equipment shall be under Division 23.

2. Under Division 26, power wiring shall be provided up to a termination point consisting of a junction box, trough, starter or disconnect switch. Under Division 26, line side terminations shall be provided. Wiring from the termination point to the mechanical equipment, including final connections and proper rotation, shall be provided under Division 23.
3. The HVAC contractor shall confirm all electrical characteristics of HVAC equipment with the Electrical Contractor prior to ordering. If procurement requirements necessitate a change in the electrical characteristics of any motor or equipment being furnished under the HVAC Contract, the respective contractor shall first obtain approval of such changes from the

Professional. This same Contractor shall also be responsible for all necessary arrangements and shall pay all costs, if any, for all required changes to the Electrical Contract.

B. Temperature Control Wiring:

1. All 120V and low voltage interconnecting control wiring in connection with the temperature control system for all heating and air conditioning systems shall be furnished, installed and connected under the HVAC Contract by the ATC vendor. The ATC vendor shall also provide power wiring from spare circuits in electric panels dedicated to mechanical equipment powered control components requiring line voltage such as actuators and timeclocks.
2. All relays; actuators; timers; timeclocks; alternators, pressure, vacuum, float, flow, pneumatic-electric, and electric-pneumatic switches; aquastats; freezestats; line and low voltage thermostats; thermals; remote selector switches; remote push-button stations; emergency break-glass stations; interlocking; disconnect switches beyond termination point, and other appurtenances associated with equipment under Division 23 shall be furnished, installed and wired under Division 23.
3. All wiring required for controls and instrumentation not indicated on the drawings shall be furnished and installed by Division 23.

C. Electrical Work for Roof Ventilators and/or Exhaust Fans:

1. For single-phase units, a motor starting-disconnecting type snap switch shall be furnished as an integral part of the roof ventilator or exhaust fan.
2. Roof exhaust fans with built-in disconnects provided under Division 23 shall be wired under Division 26 to the line side of the disconnect switch. A disconnect switch shall be provided under Division 26 if the fan is not provided with a built-in disconnect switch. In this case, the wiring from the switch to the fan shall be under Division 23.

D. Electrical Equipment by Others:

1. All electrical equipment furnished and installed under contracts other than the Electrical Contract shall be furnished with full complement of control equipment, control wiring, conduit and all other items necessary for satisfactory operation.

1.3 QUALITY ASSURANCE

A. Coordination with Electrical Work: Wherever possible, match manufacturers and types of electrical devices required under mechanical work with similar elements of electrical work specified in Division-26 sections. Comply with applicable requirements of Division-26 sections for electrical work of this section which is not otherwise specified. Refer to Section 23 05 00 on requirements for product uniformity.

B. Standards: For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology herein.

Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for each type of separate motor, starters, and other electrical devices required for mechanical work. Include electrical characteristics, ratings, list of application and general locations.

B. Wiring Diagrams: After the contractor has placed orders for all materials and equipment, he shall prepare complete wiring and control diagrams for all equipment included in this contract.

1. Identity of terminals shall agree with those used by manufacturer of equipment.
2. A minimum number of copies of these wiring diagrams as required by respective contractors shall be submitted to the Professional for approval. One (1) copy shall be retained by Architect and one (1) by Engineer for record purposes.
3. In approving diagrams, the Professional assumes no responsibility for correctness of terminal identification.

C. Maintenance Data: Submit operation and maintenance data for each type of electrical device. Include this data in Maintenance Manual in accordance with requirements of Section 23 05 00.

PART 2 PRODUCTS

2.1 MOTORS

A. General: Provide electric motors for driving the mechanical equipment. Motors shall be of proper power, construction and speed to suit the specified makes of equipment. If other makes of equipment are accepted, the proper adjustment of motor speed and power must be included without additional cost. Submit drawings for review before the equipment is purchased.

B. Motor Characteristics: Except where more stringent requirements are indicated, and except where mechanical equipment cannot be obtained with fully complying motor, comply with the following requirements for motors of mechanical work.

C. Temperature Rating: Rated for 40°C environment with maximum 50°C temperature rise for continuous duty at full load (Class A Insulation). Where normal operating temperature will exceed this rating, provide Class B, F or H insulation as required.

D. Starting Capability: Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hours for manually controlled motors.

1. Fan motors shall be capable of accelerating their respective fans from 0 revolutions per minute to design or synchronous revolutions per minute within a maximum of 10 seconds. Submit to the Engineer for review curves which plot time versus revolutions per minute for the particular motor and fan combination.

E. Phases and Current Characteristics: Provide squirrel-cage induction polyphase motors for 1/2 hp and larger, and provide capacitor-start single-phase motors for 1/3 hp and smaller, except 1/6 hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division-26 sections, and with individual equipment requirements specified in other Division-23 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

F. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.

1. Coordinate the NEMA type of each motor with the torque and inertia load of the equipment served, and the inrush characteristics of the motor with the starter selection, so that all items furnished constitute a properly related package. No motor shall operate in the service factor range.

G. Motor Construction: Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque motors and accessories shall comply with NEMA Standards.

1. Frames NEMA No. 48
2. Bearings: Ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is normally inaccessible for regular maintenance.
    a. Where belt drives and other drives produce lateral and axial thrust, in motor, provide bearings designed to resist thrust loading. Refer to individual sections of Division 23 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
3. Enclosure Type: Except as otherwise indicated, provide TEFC motors. Provide totally enclosed fan cooled (TEFC) weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 23 for other enclosure requirements.
4. Overload Protection: Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
5. Noise Rating: Provide "Quiet" rating on motors, guaranteed to fulfil the specified requirements without producing any objectionable sound audible outside of machine rooms and which prohibits maintaining room NC levels as specified.

6. Efficiency: In accordance with IEEE Standard 112, test method B and NEMA Standards Publication MG1-2006.
    a. Motors of less than 1 horsepower shall be industry “standard” efficiency motors.
    b. Motors 1 horsepower or greater shall be “Premium Efficiency” as defined by energy efficiency levels mandated by the Energy Policy Act of 1992 in accordance with NEMA Publication MG 1-2006, Table 12-12, Full Load Efficiency for NEMA Premium Efficiency Motors.
        1) Motor nameplates shall be labeled with a Department of Energy approved code including the motor manufacturer’s specific compliance number issued by DOE. Each motor nameplate shall also display the NEMA nominal efficiency.
    c. All motors supplied with variable speed drives shall be inverter ready.

H. Name Plate: Provide metal nameplate on each motor, indicating full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

I. Acceptable Manufacturer: Subject to compliance with requirements provide motors for mechanical equipment by one of the following: Except where item of mechanical equipment (which otherwise complies with requirements) must be integrally equipped with motor produced by another manufacturer:
1. Baldor Electric Co.
2. Eaton Corp.
3. General Electrical Co.
4. Lincoln Electric Co.
5. Magne Tek
6. Marathon Electric Mfg. Corp.
7. Reliance Electric Co.
8. Westinghouse Electric Corp.

2.2 ELECTRICAL DEVICES AND WIRING

A. Motor Connections: Provide flexible-conduit motor connections except where plug-in electrical cords are specifically indicated. Comply with applicable provisions of Division-26 sections for wiring materials and wiring devices. Refer to individual equipment sections for special high-voltage (600 volts and over) and star-delta connected motor requirements.

2.3 MOTOR STARTERS AND SAFETY DISCONNECT SWITCHES

A. All motor starters and safety switches provided by Mechanical Contractor shall be in accordance with all requirements of Division 26. Provide NEMA-type enclosure consistent with environment in which starters will be mounted. Provide size of starter recommended by motor and/or equipment manufacturer for applicable protection and start-up condition; refer to equipment schedules for basic load requirements. Provide Hand/Off/Auto switch.

1. Manual Switches: Provide molded plastic manual switch with pilot light for motors ½ hp and smaller, except where interlock or automatic operation is indicated. Include overload trip assembly, one per phase.
2. Combination Magnetic Starters: Provide combination magnetic starters with circuit breaker disconnect for motors ¾ hp and larger, and for smaller motors where interlock or automatic operations is indicated.
3. Magnetic motor starters: Same as above without circuit breaker disconnect where disconnecting means is provided by others.
4. Safety Disconnect Switches: Where motor starters are part of the HVAC packaged equipment and a separate safety disconnect is required, furnish in accordance with the requirements of Division 26.

2.4 EMERGENCY STOP SWITCHES (ESS)

A. GENERAL: Where indicated, provide emergency stop switches in accordance with the following:

1. 1-3/8” diameter red mushroom push button, twist to reset, single gang coverplate. Contacts as required.
2. Hinged clear acrylic protective cover.
3. Engraved nameplate fastened to wall above switch. Refer to drawings for nameplate nomenclature.

2.5 EQUIPMENT FABRICATION

A. General: Fabricate mechanical equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives, arranged for lubrication and similar running-maintenance without removal of guards, in accordance with OSHA Standards.

2.6 CONTROL WIRING

A. Digital signal wiring shall be NEC class 2. Analog signal wiring shall be #18 copper wire or control cable. All control wiring shall be plenum rated regardless of whether it is in a plenum or in conduit.

B. All control conductors shall be color-coded. Where conductors pass through a junction box or connect to a device, the conductor and box shall be tagged to indicate the circuit and terminal number as designated on the controls shop drawings.

C. There shall be no splices in the control system other than at terminal boxes. Wire nuts and crimps are not permitted.

D. All terminal block screws shall have pressure wire connectors of the self-lifting or box lug type.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, securely anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws, except motors of 1/3 hp and less may be secured with Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Each motor shall be factory wired to a junction box mounted on the motor or on the driven piece of equipment to facilitate single point field power connection under Division 26.

C. The Mechanical Contractor shall install starters and wiring devices at locations indicated, securely supported and anchored, and in accordance with manufacturer's installation instructions and the National Electric Code. Locate for proper operational access, including for visibility and safety.

D. Check overload relay heaters with motor nameplate full load current. Change heaters per manufacturer's recommendation if not correctly rated at no cost to Institution.

E. Investigate and correct cause of motors operating above full load rating instead of increasing overload relay trip setting.

3.2 RACEWAYS

A. All power and control wiring by Mechanical Contractor shall be in raceways complying with Division 26.

3.3 COORDINATION

A. After the contractor receives the engineer’s and approval, they shall then deliver the required minimum number of copies of the approved wiring diagram to the electrical contractor.

B. The contractor shall render whatever assistance is required by the electrical contractor in making connections to control devices furnished by the contractor.

END OF SECTION 230523

SECTION 230553 MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division-23 sections. The contractor is to coordinate the locations and color of all markers with the engineer and the owner prior to beginning the work.

B. Types of identification devices specified in this section include the following:

1. Plastic Pipe Markers
2. Plastic Duct Markers
3. Plastic Tape
4. Valve Tags
5. Valve Schedule Frames
6. Engraved Plastic-Laminate Signs
7. Plastic Equipment Markers
8. Plasticized Tags
9. Ceiling Stickers

C. Mechanical identification furnished as part of factory-fabricated equipment, is specified as part of equipment assembly in other Division-23 sections.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards: ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

C. Owner Coordination: Coordinate and comply with owner’s existing identification nomenclature.

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency

shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 1.

C. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering mechanical identification materials which may be incorporated in the work include; but are not limited to, the following:

1. Allen Systems, Inc.
2. Brady (W.H.) Co.; Signmark Div.
3. Industrial Safety Supply Co., Inc.
4. Seton Name Plate Corp

2.2 MECHANICAL IDENTIFICATION MATERIALS:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

2.3 DUCT MARKERS:

A. General - Provide manufacturer's standard laminated plastic, color coded duct markers. Conform to the following color code:

1. Green: Supply Air
2. Yellow: Outside Air
3. Red: Exhaust Air
4. Blue: Return Air

B. Nomenclature - Include the following:

1. Direction of air flow.
2. Duct service (supply, return, exhaust, etc.)

C. Provide ½" color tape labels on Grid ceiling to identify Other Systems as follows:

System	Color / Lettering
Balancing Dampers	Dark Blue / BD
Fire Dampers	Red / FD

2.4 ENGRAVED PLASTIC-LAMINATE SIGNS:

A. General: Provide engraving stock, melamine plastic laminate, complying with FS L-P-387, in the sizes and thickness indicated. Engrave with engraver's standard letter style of the sizes and wording indicated with black letters on light contrasting background except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.5 PLASTIC EQUIPMENT MARKERS:

A. General: Provide manufacturer's standard laminated plastic, color coded equipment markers. Conform to the following color code or that approved by the owner.

1. Green: Supply system equipment and components.
2. Yellow: Outside air equipment and components.
3. Blue: Relief air equipment and components.
4. Red: Exhaust equipment and components.
5. Black: Equipment and components that do not meet any of the above criteria.

B. For hazardous equipment, use colors and designs recommended by ANSI A13.1.

C. Nomenclature: Include the following, matching terminology on schedules as closely as possible:

1. Name and plan number.
2. Equipment service.

D. Size: Provide approximate 2-1/2" x 4" markers for control devices, dampers, and valves; and 4-1/2" x 6" for equipment

2.6 PLASTICIZED TAGS:

A. General: Manufacturer's standard pre-printed or partially pre-printed accident-prevention tags, of plasticized card stock with matt finish suitable for writing, approximately 3-1/4" x 5-5/8", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

2.7 LETTERING AND GRAPHICS:

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not

otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

B. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS:

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 DUCTWORK IDENTIFICATION:

A. General: Identify air supply, return, exhaust, intake and relief ductwork with color coded duct markers or stenciled painting; showing ductwork service, associated air handling system, area served and direction of flow.

B. Location: In each space where ductwork is exposed, or concealed only by removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment), and 20' spacings along exposed runs.

C. Access Doors: Provide duct markers or stenciled signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.

3.3 MECHANICAL EQUIPMENT IDENTIFICATION:

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Variable Volume Terminal Units: provide plastic nameplates
2. Relief fans, exhaust fans: provide plastic nameplates.
3. Air Handling Units: provide plastic nameplates.
4. Filters, humidifiers, and similar equipment: provide tags.
5. Thermostats-relate to associated terminal boxes with plastic nameplates.

B. Optional Sign Types: Where lettering larger than 1" height is needed for proper identification, because of distance from normal location of required identification, stenciled signs may be provided in lieu of engraved plastic, at Installer's option.

C. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.

D. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicated safety and emergency precautions, and warn of hazards and improper operations.

E. Optional Use of Plasticized Tags: At Installer's option, where equipment to be identified is concealed above acoustical ceiling or similar concealment, plasticized tags may be installed within concealed space to reduce amount of text in exposed sign (outside concealment).

F. Operational valves and similar minor equipment items locate in non-occupied spaces may, at Installer's option, be identified by installation of plasticized tags in lieu of engraved plastic signs.

3.4 ADJUSTING AND CLEANING:

A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION 230553

SECTION 230593 TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section specifies the requirements and procedures for total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications and recording and reporting the results.

B. Test, adjust, and balance the following mechanical systems:
   1. Supply air systems.
   2. Return air systems.
   3. Exhaust air systems.
   4. Outside air systems.

C. Verify and measure final operating conditions of HVAC systems.

D. This section does not include:

   1. Testing boilers and pressure vessels for compliance with safety codes.
   2. Specifications for materials for patching mechanical systems.
   3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.

1.2 DEFINITIONS

A. System testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:

   1. The balance of air and water distribution.
   2. Adjustment of total system to provide design quantities.
   3. Electrical measurement.
   4. Verification of performance of all equipment.

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.

E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

F. Report Forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

G. Terminal: The point where the controlled fluid enters or leaves the distribution system. These are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

H. Main: Duct or pipe containing the system's major or entire fluid flow.

I. Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.

J. Branch Main: Duct or pipe serving two or more terminals.

K. Branch: Duct or pipe serving a single terminal.

1.3 QUALITY ASSURANCE

A. Agency Qualifications:

1. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications and recording and reporting the results.
2. The independent testing, adjusting and balancing agency shall be certified by the Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB) in those testing and balancing disciplines required for this project and shall have at least one individual on staff certified by AABC or NEBB as a Test and Balance Engineer (TBE).

B. Codes and Standards: Comply with the following:

1. AABC - National Standards for Total System Balance.
2. SMACNA - HVAC Systems Testing, Adjusting, and Balancing.
3. NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.

C. Supplemental Requirements:

1. The T&B contractor shall maintain logs, in a form acceptable to the engineer, to demonstrate that at least 50% of the measurements used in the Test and Balance procedures were made while an individual certified by AABC or NEBB as a Test and Balance Engineer was on the job site.
2. All T&B shall be performed to AABC and NEBB least energy guidelines. Critical branch balancing devices shall be not less than 90% open. Critical path shall be hilited on T&B reports.

1.4 SCHEDULE

A. Final Test and Balance reports for both air and water systems are considered life safety items. Final T & B Reports shall be completed, reviewed and approved by the Engineer prior to scheduling a Final Inspection. Any pre-final draft is not acceptable.

1.5 SUBMITTALS

A. Agency Data: Submit name of and proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified.

B. Engineer and Technicians Data: Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified.

C. Procedures and Agenda: Prior to commencing work, submit a synopsis of the testing, adjusting, and balancing procedures equipment and agenda proposed to be used for this project.

D. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

E. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

F. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems. Include this information in maintenance data specified in Mechanical General Requirements.

G. Sample Forms: Submit sample forms, if other than those standard forms prepared by the AABC or NEBB are proposed.

H. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the system are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

1. Draft Reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be handwritten, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit [2] complete sets of final reports to be included in the project O & M manuals. Coordinate with requirements of Mechanical General Requirements.
3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:
    a. Index
    b. General Information and Summary
    c. Air Systems
    d. Temperature Control Systems
    e. Special Systems
    f. Sound and Vibration Systems

4. Report Contents: Provide the following minimum information, forms and data:
   a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Professional, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.
   b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets. Indicate final thermostat locations.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Mechanical General Requirements.

B. Record actual locations of flow measuring stations, balancing valves, and rough setting.

C. Pre-Balancing Conference.

D. Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Professional and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1.7 SEQUENCING AND SCHEDULING

A. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

B. Test, adjust, and balance the air systems before hydronic systems.

PART 2 PRODUCTS – This application not used.

PART 3 EXECUTION

3.1 CONTRACTOR COOPERATION

A. Mechanical contractor shall cooperate with the balancing firm to:

1. Provide sufficient time before completion date so that balancing can be accomplished.
2. Provide immediate labor and tools to make corrections without delay.
3. Place heating, ventilating and air conditioning systems and equipment into full operation and continue the operation for each working day of testing and balancing.
4. Provide approved shop drawings to testing and balancing firm and advise them of changes made to the system during construction.
5. Install required test holes complete with removable and replaceable plugs.
6. Make necessary revisions to controls, dampers, fan and pump drives and consult with equipment manufacturers as required to achieve the specified system's performance.
7. Provide ladders, scaffolds, tools and labor to assist the work of the balancing firm, including removing ceiling tiles, guards, adjusting pulleys, belts; replace when finished.
8. Control manufacturer shall work with the balancing firm when setting damper linkages and minimum outside air dampers. The control manufacturer shall be available for readjusting of dampers or controls that are not properly calibrated.
9. Set pressure regulating, automatic fill and reducing valves to operating and code conditions.
10. Check and set relief and safety valves to code requirements.
11. Clean strainers. Check air filters immediately prior to air balancing.
12. Lubricate all motors and bearings.

3.2 EXAMINATION

A. The TAB agency shall review contract documents in detail within 30 days of notice to proceed and advise the professional where additional balancing devices or other modifications are required.

B. If contractor shall cooperate with the balancing firm to:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.

4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Proper strainer baskets are clean and in place.
13. Service and balance valves are open.

C. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

D. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations.

1. Make instruments available to Professional to facilitate spot checks during testing.

3.4 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

A. Before operating the system, perform these steps:

1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.
3. Compare design to installed equipment and field installations.
4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
5. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a cross check with required fan volumes.
6. Determine best locations in main and branch ductwork for most accurate duct traverses.
7. Place outlet dampers in the full open position.
8. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.

9. Check fan belt tension.

3.5 PRELIMINARY PRODECURES FOR HYDRONIC SYSTEM BALANCING

A. Before operating the system perform these steps:

1. Open valves to full open position. Close coil bypass valves.
2. Check expansion tanks to determine that they are not air bound and that the system is completely full of water.
3. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or to bleed air completely (manual type).
4. Set temperature controls so all coils are calling for full flow.
5. Check operation of automatic bypass valves.
6. Check to set operating temperatures of chillers to design requirements.

3.6 INSTALLTION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5% of design for supply systems and plus or minus 10% of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10% and minus 5% of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.7 MEASUREMENTS

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. Apply instrument as recommended by the manufacturer.

E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5%. When measuring a single

point, repeat readings until 2 consecutive identical values are obtained.

G. Take all reading with the eye at the level of the indicated value to prevent parallax.

H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

I. Take measurements in the system where best suited to the task.

3.8 PERFORMING TESTING, ADJUSTING AND BALANCING

A. General: Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

1. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.
2. Patch insulation, ductwork, and housings, using materials identical to those removed.
3. Seal holes in ducts and piping, relating to TAB procedures, and test for and repair leaks.
4. Seal insulation to re-establish integrity of the vapor barrier.
5. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.
6. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

B. Adjusting:

1. Ensure recorded data represents actual measured or observed conditions.
2. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
3. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
4. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

5. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
6. Check and adjust systems approximately six months after final acceptance and submit report.

C. Air System Procedure:

1. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
2. Make air quantity measurements in ducts by Pitot tube traverse of entire cross-sectional area of duct.
3. Measure air quantities at air inlets and outlets.
4. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
5. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
6. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
7. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
8. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50% loading of filters.
9. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
10. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
11. Where modulating dampers are provided, take measurements and balance at extreme conditions. (Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.)
    a. The TAB Agency shall be responsible for setting and recording the set points for maximum and minimum air flows and for providing the necessary equipment, computers, instrumentation and qualified technicians for providing these services.
12. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.03 inches (12.5 Pa) positive static pressure near the building entries. Review with the Professional the actual measured building static pressure after the systems have been totally balanced. The Professional shall determine if it is

advisable to change the outdoor air quantities due to the possibility of overloading the heating or cooling equipment.

13. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections are properly made and confirm proper operation for automatic variable air volume temperature control.

3.9 RECORD AND REPORT DATA

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

3.10 ACCEPTANCE

A. At the completion of balancing procedures, allow for a minimum of two days for the Professional to witness test procedures and conduct operational tests.

B. Mechanical systems shall not be considered ready for final inspection until balancing results acceptable to the Professional are obtained.

C. If it is found that the specified air flows cannot be achieved on portions of the system, the actual conditions shall be reported to the Professional for consideration of corrective action before continuing the balancing procedure.

D. If measured flow at final inspection shows deviation of 10% or more from the certified report listings for more than 10% of selected areas, the report shall be rejected.

E. If report is rejected, systems shall be rebalanced, and a new certified report submitted.

3.11 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:

1. Air Coils
2. Terminal Heat Transfer Units
3. Air Handling Units
4. Fans

5. Air Terminal Units
6. Air Inlet and Outlets
7. Dampers and Valves

B. Report Forms

1. Title Page:
   a. Name of Testing, Adjusting and Balancing Agency
   b. Address of Testing, Adjusting and Balancing Agency
   c. Telephone number of Testing, Adjusting and Balancing Agency
   d. Project Name
   e. Project Location
   f. Project Architect
   g. Project Engineer
   h. Project Contractor
   i. Report Date
2. Summary Comments:
   a. Design versus final performance
   b. Notable characteristics of system
   c. Description of systems operation sequence
   d. Summary of outdoor and exhaust flow to indicate amount of building pressurization
   e. Nomenclature used throughout report
   f. Test conditions
3. Instrument List:
   a. Instrument
   b. Manufacturer
   c. Model Number
   d. Serial Number
   e. Range
   f. Calibration Date
4. Electric Motors:
   a. Manufacturer
   b. Model/Frame
   c. HP/BHP
   d. Phase, voltage, amperage, nameplate, actual, no load
   e. RMP
   f. Service Factor
   g. Starter size, rating, heater elements
   h. Sheave make/size/bore
5. V-Belt Drive:
   a. Identification/Location
   b. Required drive RPM
   c. Driven sheave, diameter and RPM
   d. Belt, size and quality

e. Motor sheave diameter and RPM
f. Center to distance, maximum, minimum and actual

6. Cooling Coil Data:
7. Heating Coil Data:
8. Air Moving Equipment:
   a. Location
   b. Manufacturer
   c. Model Number
   d. Serial Number
   e. Arrangement/Class/Discharge
   f. Air flow, specified and actual
   g. Return air flow, specified and actual
   h. Outside air flow, specified and actual
   i. Total static pressure (total external), specified and actual
   j. Inlet pressure
   k. Discharge pressure
   l. Sheave Make/Size/Bore
   m. Number of Belts/Make/Size
   n. Fan RPM
9. Return Air/Outside Air Data:
   a. Identification/Location
   b. Design air flow
   c. Actual air flow
   d. Design return air flow
   e. Actual return air flow
   f. Design outside air flow
   g. Actual outside air flow
   h. Return air temperature
   i. Outside air temperature
   j. Required mixed air temperature
   k. Actual mixed air temperature
   l. Design outside/return air ratio
   m. Actual outside/return air ratio
10. Exhaust Fan Data:
    a. Location
    b. Manufacturer
    c. Model Number
    d. Serial Number
    e. Air flow, specified and actual
    f. Total static pressure (total external), specified and actual
    g. Inlet pressure
    h. Discharge pressure
    i. Sheave Make/Size/Bore
    j. Number of Belts/Make Size
    k. Fan RPM
11. Duct Traverse:

a. System zone/branch
b. Duct size
c. Area
d. Design velocity
e. Design air flow
f. Test velocity
g. Test air flow
h. Duct static pressure
i. Air temperature
j. Air correction factor

12. Terminal Unit Data:
    a. Manufacturer
    b. Type, constant, variable, single, dual duct
    c. Identification/Number
    d. Location
    e. Model number
    f. Size
    g. Minimum static pressure
    h. Minimum design air flow
    i. Maximum design air flow
    j. Maximum actual air flow
    k. Inlet static pressure
13. Air Distribution Test Sheet:
    a. Air terminal number
    b. Room number/Location
    c. Terminal Type
    d. Terminal Size
    e. Area factor
    f. Design velocity
    g. Design air flow
    h. Test (final) velocity
    i. Test (final) air flow
    j. Percent of design air flow

3.12 DEMONSTRATION

A. At the request of the design Professional, the TAB Contractor shall repeat the balancing procedure for any system or portion of a system in the presence of the Professional and Owner's representative.

END OF SECTION 230593

SECTION 230700 MECHANICAL INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for the correct fabrication and installation of thermal insulation applied to the piping, equipment, and duct systems indicated on the Drawings and specified herein.

B. Types of mechanical insulation specified in this section include the following for piping and ductwork:

1. Fiberglass
2. Flexible Unicellular
3. Rigid Polyisocyanurate
4. Encapsulated ceramic fiber blanket

C. Certain equipment and/or systems to be factory insulated by manufacturer. Factory insulation materials are to be as specified in applicable sections of the specifications.

1.2 QUALITY ASSURANCE

A. Insulation materials, including all weather and vapor barrier materials, closures, hangers, supports, fitting covers, and other accessories, shall be furnished and installed in strict accordance with project drawings and specifications by skilled workers who have at least five years of successful experience in commercial insulation work.

B. All insulation work shall comply with the following codes and standards:

1. Certify that all insulation meets the minimum requirements of the current State Energy Code for New Building Construction.
2. NAIMA Insulation Standards
3. ASTM E-84
4. NFPA 255
5. UL 723
6. NFPA 90A
7. NFPA96

C. Thermal insulation materials shall meet the property requirements of the following specifications as applicable to the specific product or use:

1. American Society for Testing of Materials Specifications:
    a. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
    b. ASTM C585 - Recommended Practice for Inner and Outer Diameters of Rigid Pipe Insulation for Nominal Sizes of Pipe and Tubing (NPS System)".
    c. ASTM C591 – "Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation".
    d. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
    e. ASTM C1136 – "Standard Specification for Barrier Material, Vapor", Type 1 or 2 (jacket only)".
    f. ASTM D1667 - Standard Specification for Flexible Cellular Materials--Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
    g. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

D. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 method.

1. Exception: Mechanical insulation where specifically called out in this specification may have flame spread index of 75 and smoke developed index of 450.
2. Insulation jacket for duct, pipe, and equipment exposed to weather to be certified as self-extinguishing in less than 53 seconds when tested in accordance with ASTM D1692.

E. Insulation exposed to view shall have a well-tailored appearance.

1.3 REFERENCE STANDARDS

A. The following industry standards form a part of these specifications by mention herein.

1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]).
3. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.

4. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
5. ASTM C240 - Standard Test Methods of Testing Cellular Glass Insulation Block.
6. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
7. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
8. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
9. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
10. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
11. NAIMA National Insulation Standards.
12. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
13. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

1.4 DEFINITIONS

A. Thermal resistance of “R” values are expressed in units of “Hours-Degrees F-sq. ft/Btu per inch of Thickness” on a flat surface at a mean temperature of 75 degrees F unless noted otherwise.

B. Thermal conductivity (K), the reciprocal of “R”, btu/hr/f ^{2}/degree.

C. Insulation to consist of insulating material, jacket, mastic, and adhesive, either as a “system” or as an individual component when used separately.

1.5 SUBMITTALS

A. Product data: Submit manufacturer’s technical product data for each type of mechanical insulation. Submit schedule showing manufacturer’s product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.

1.6 DELIVERY AND STORAGE OF MATERIALS

A. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.

B. The contractor shall use whatever means are necessary to protect the insulation

materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The contractor shall also use all means necessary to protect work and materials installed by other trades.

C. If any insulation material has become wet because of transit or job site exposure to moisture or water, the contractor shall not install such material, and shall remove it from the job site. An exception may be allowed in cases where the contractor is able to demonstrate that wet insulation when fully dried out (either before installation, or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in all respects to new, completely dry insulation. In such cases, consult the insulation manufacturer for technical assistance.

PART 2 - PRODUCTS

2.1 INTERIOR DUCTWORK INSULATION MATERIALS

A. General: Ductwork operating at temperatures up to +450□ F shall be insulated with fiberglass insulation in blanket, batt, or board form. The insulation shall be selected to conform readily to the surface to which it will be applied. Observe manufacturer's recommendations on maximum temperature/thickness combinations. Before installing insulation, inspect to make sure that all seams and joints in the ductwork have been sealed by the responsible contractor.

B. Flexible Fiberglass Ductwrap: For indoor service at operating temperatures to +250□ F on round or rectangular ductwork provide 0.75 lb/ft^3 glass fiber insulation in roll form, faced with a reinforced foil/kraft laminate, meeting the requirements of ASTM C 553. Thickness specified is based on an out of package k-value of 0.27 BTU-in/hr-sq. ft.-degree F.

C. Jackets for Ductwork Insulation: ASTM C 921, Vapor Barrier type for ductwork with temperatures below ambient; water permeable type for ductwork with temperatures above ambient.

D. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulating manufacturer for applications indicated.

E. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

2.2 PIPING INSULATION MATERIALS

A. General: Molded pipe insulation shall be manufactured to meet ASTM C 585 for sizes required in the particular system. It shall be of a type suitable for installation on piping systems, including fittings and valves. Fitting insulation to be of same thickness and material as adjoining pipe insulation.

B. TYPE E – FLEXIBLE UNICELLULAR FOAM PIPING INSULATION:

1. Insulation: ASTM C534; flexible, unicellular elastomeric, molded slit tubing, or sheet.
2. 25 flame spread and 50 smoke development ratings.
3. 'K' value: ASTM C177; 0.27 at 75 degrees F.
4. Minimum service temperature: -40 degrees F.
5. Maximum service temperature: 220 degrees F.
6. Maximum moisture absorption: ASTM D1056; 3.0 percent by volume (Pipe), 6.0 (sheet).
7. Moisture vapor transmission: ASTM E96; 0.17 perm-inches.
8. Butt joints: Neoprene contact adhesive.
9. Provide all insulation exposed to weather with two coats of water based latex enamel as recommended by insulation manufacturer.
10. Subject to compliance with requirements, acceptable manufacturers include:
    a. Armstrong Armaflex
    b. Rubatex

C. Jackets for Piping Insulation:

1. Provide Manufacturer’s standard white craft jacket unless indicated elsewhere in this specification. Provide canvas jacket in mechanical rooms and all other locations where exposed to view. Provide PVC plastic fitting covers wherever white kraft or canvas jackets are specified.
    a. Shall comply with requirements of ASTM C 921.
    b. Use vapor barrier type for piping with temperatures below ambient, vapor permeable type allowable for piping with temperatures above ambient or where closed-cell, non-permeable insulation is used. Vapor barrier type may be used for all piping at Installers option.
    c. Provide aluminum jackets in addition to white kraft or canvas jacket for all exterior applications and to 10 feet above finished floor in mechanical equipment rooms.
    d. Jackets are not required for insulation type “E”.
2. PVC Plastic. Provide PVC jackets where specifically noted on the drawings, or where indicated elsewhere in this specification.
    a. Jacket: ASTM D1784, one-piece molded type fitting covers and sheet material, white color.
    b. Minimum service temperature: 0 degrees F.
    c. Maximum service temperature: 150degrees F.
    d. Moisture vapor transmission: ASTM E96; 0.002 perm-inches.

e. Thickness: 15 mil.
f. Connections: Brush on welding adhesive or pressure sensitive color matching vinyl tape.
g. Subject to compliance with requirements, acceptable manufacturers include:
(i) Ceel-Co
(ii) Proto Corp.
(iii) Exact-Fit
(iv) Speedline

3. Canvas Jacket: UL listed. Fabric: ASTM C921, 6 oz/sq yd, plain weave cotton treated with dilute fire retardant lagging adhesive.
4. Aluminum Jacket: ASTM B209 or ASTM B209M.
a. Thickness: 0.016 inch.
b. Finish: Embossed.
c. Joining: Longitudinal slip joints and 2 inch.
d. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
e. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 thick stainless steel.
f. Subject to compliance with requirements, acceptable manufacturers include:
(i) Proto
(ii) Ceel-Co
(iii) Pabco
(iv) RPR Products
(v) Childers

D. Staples, Bands, Wires: As recommended by insulation manufacturer for applications indicated.

E. Adhesives, Sealers, Cement and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

1. Subject to compliance with requirements, acceptable manufacturers include: Foster, Childers, 3M, Marathon, Pittsburgh Corning, Vimasco.

2.3 MATERIALS FOR FITTINGS AND VALVES

A. Provide factory pre-molded one-piece PVC insulated fitting covers, precut insulation inserts and installation materials for the following services:
1. All pipe fittings and valves.
2. All grooved coupling installations.
3. Hot surfaces; apply with stainless steel tacks or staples or draw bands.
4. Cold surface; use 2" wide, 10 mil vapor barrier tape furnished by manufacturer of jacket or vapor barrier mastic and drawbands. Do not puncture vapor barrier with tacks or staples.

B. Materials to be equal to be Foster Seaglass PVC fitting cover, UNI-Fit inserts and accessories, or equivalent by Molded Acoustical Products, Inc., Hamfab, Zeston division of Mansfield; or Armstrong Products.

2.4 EQUIPMENT INSULATION MATERIALS

A. General: Vessels, tanks, and equipment operating at temperatures up to 450□ F shall be insulated with glass fiber or closed cell foam insulation selected to conform readily to the surface to which it will be applied.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. Verify that all materials and accessories can be installed in accordance with project drawings and specifications and material manufacturer's recommendations.

C. Verify by inspecting product labeling, submittal, data, and/or certifications which may accompany the shipments that all materials and accessories to be installed on the project comply with applicable specifications and standards and meet specified thermal and physical properties

3.2 PREPARATION

A. All pipe, ductwork and equipment surfaces over which insulation is to be installed shall be clean and dry when insulation is applied.

B. Ensure that insulation is clean, dry, and in good mechanical condition with all factory-applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation.

C. Ensure that pressure testing of piping or duct systems has been completed prior to installing insulation. Ensure that all seams and joints in ductwork have been sealed by the contractor responsible for the ductwork.

D. All adhesives, cements and mastics to be compatible with materials applied without attacking materials in either wet or dry state.

3.3 INSTALLATION OF PIPE INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions and NAIMA National Insulation Standards to ensure that insulation serves its intended purpose.

B. Install insulation on systems subsequent to installation of heat tracing, painting, testing and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. In exposed areas, orient and cover seams in least visible locations.

D. Clean and dry surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

E. For insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
   3. For hot piping conveying fluids 160 degrees F or less, do not insulate flanges and unions at equipment, and bevel and seal ends of insulation.
   4. For hot piping conveying fluids over 160, insulate flanges and unions at equipment.

F. For insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe and cover with PVC fitting covers.
   3. Maintain integrity of vapor-barrier jackets on insulation, and protect to prevent puncture, tears, or other damage.
   4. All valve stems must be sealed with caulking that allows free movement of the stem but provides a seal against moisture incursion.

G. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
   1. Exception: Do not insulate valves in systems operating above 60 degrees F and where installed in valve boxes outdoors. Paint valves with a rust-resistant product equivalent to Rustoleum.

H. Fittings and valves shall be insulated with pre-formed fittings, fabricated sections of pipe insulation of same material as pipe insulation, fiberglass pipe and tank insulation, fiberglass blanket insulation, or insulating cement. Thickness shall be equal to adjacent pipe insulation. Finish shall be with pre-formed PVC fitting covers or as otherwise specified on contract drawings. Miter cutting of pipe insulation is acceptable for fittings provided that it is neatly and

accurately done with no less than 4 miter sections per 90 degree elbow.

1. Flanges, couplings and valve bonnets shall be covered with an oversized pipe insulation section sized to provide the same insulation thickness as on the main pipe section. An oversized insulation section shall be used to form a collar between the two insulation sections with low density blanket insulation being used to fill gaps. Jacketing shall match that used on straight pipe sections. Rough cut ends shall be coated with a suitable weather or vapor resistant mastic as dictated by the system location and service.
2. On hot systems where fittings are to be left exposed, insulation ends should be beveled away from bolts for easy access.
3. On cold systems (below ambient temperature), particular care must be given to vapor sealing the fitting cover or finish to the pipe insulation vapor barrier

I. Extend insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

J. All final pipe insulation ends shall be tapered and sealed regardless of service.

K. All piping shall be supported in such a manner that neither the insulation or the vapor/weather barrier is compromised by the hanger or the effects of the hanger. In all cases, hanger spacing must be such that the circumferential joint may be made outside the hanger. On cold systems, vapor barrier must be continuous, including material covered by the hanger saddle.

1. For hot or cold piping systems, operating at temperatures less than +200°F and insulated with low density insulation, shields as above and high density inserts such as cellular glass foam with sufficient compressive strength shall be used to support the weight of the piping system. At temperatures exceeding +200°F, Calcium Silicate pipe insulation shall be used for high density inserts.
    a. Insert location: Between support shield and piping and under the finish jacket.
    b. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
    c. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.
2. Where pipe shoes and roller supports are required, insulation shall be inserted in the pipe shoe to minimize pipe heat loss. Where possible, the pipe shoe shall be sized to be flush with the outer pipe insulation diameter.
3. Thermal expansion and contraction of the piping and insulation system can generally be taken care of by utilizing double layers of insulation and staggering both longitudinal and circumferential joints. Where long runs are encountered, expansion joints may be required where single layers of insulation are being used and should be so noted on the contract drawings.
4. On vertical runs, insulation support rings shall be used.

L. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with 0.016” aluminum jacket equivalent to Childers and cover fittings with factory formed covers equivalent to Elljacs.

3.4 INSTALLATION OF DUCT SYSTEM INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions and NAIMA National Insulation Standards to ensure that insulation serves its intended purpose.

B. Ductwrap Insulation: Duct wrap insulation shall be applied with all joints butted firmly together using manufacturer’s recommended stretch-out tables to prevent excessive compression. All joints in the insulation covering shall be sealed with adhesive. Ductwrap insulation shall be secured to bottom and sides of rectangular or oval ducts with mechanical fasteners on 16" (max) centers to prevent sagging. Vapor barrier shall be legibly printed by the manufacturer to show nominal thickness, R-value, and type of insulation.
   1. All joints and seams shall be stapled with outward clinching staples at 6" (approx.) centers.
   2. Use insulation having 2-inch tab, or cut insulation long enough to allow for “peel-off” of insulation form jacket to effect a minimum overlap tab of 2-inch.
   3. Where a vapor barrier is required (ductwork conveying air below ambient temperature) all joints, seams, tears, punctures, and other penetrations shall be closed with 3" pressure-sensitive tape matching the facing or with a vapor barrier mastic reinforced with 3" glass scrim tape.
   4. Apply jacketed blanket type glass fiber pulled snug to ducts but not more than 1/2-inch compression at corners.
   5. Cover standing seams, stiffeners, and braces with an insulation blanket, using 2-inch jacket lap and staple lap.
   6. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

C. Rigid Insulation:
   1. Board shall be secured to ductwork with mechanical fasteners and insulation caps and washers within 3" (max.) of board edges and 12" (max.) on center.
   2. All joints shall be firmly butted and closed with matching 3" pressure-sensitive tape or with a vapor barrier mastic reinforced with 3" glass scrim tape. For outdoor systems, the standard facing must be overcoated with a suitable weather barrier mastic reinforced with fabric or mesh.
   3. Un-faced insulation systems may be finished using finishing cement reinforced with wire mesh and corner bead or sheet metal lagging properly overlapped and secured.
   4. Corner angles shall be installed on all external corners of rigid insulation prior to installing the jacket.

D. Insulated ductwork or equipment operating below ambient temperature:
   1. Provide insulation with vapor barrier jacket and seal all edges, seams, joints, punctures or any other breaks in vapor barrier with commercial grade, aluminum vapor barrier tape.
   2. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations, except as noted otherwise for rated assemblies.

E. Air Distribution Devices: Where ductwork is specified to be insulated, pan of air distribution device shall be insulated also.

3.5 INSTALLATION OF EQUIPMENT INSULATION

A. Factory Insulated Equipment: Do not insulate.

B. Finish insulation at supports, protrusions, and interruptions.

C. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands as appropriate. Coat insulated surfaces on equipment with layer of insulating cement, troweled in workmanlike manner, leaving smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities. On cold equipment, use vapor barrier cement.
   1. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship

D. Do not apply insulation to equipment, breechings, or stacks while hot.

E. Apply insulation using staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.

F. Areas left uninsulated: Items such as boiler manholes, handholes, clean-outs, ASME stamp, and manufacturer's nameplates, may be left uninsulated unless omitting insulation would cause a condensation problem. When such is the case, appropriate tagging shall be provided to identify the presence of these items. Provide neatly beveled edges at interruptions of insulation.

G. Provide removable insulation sections to cover parts of equipment that must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

H. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.

3.6 INSTALLATION OF ONE-PIECE PVC INSULATION FITTING COVERS

A. Pre-molded fitting covers to be precisely cut or mitered to fit or be tucked snugly into the throat of fitting and edges adjacent to pipe covering and taped to form a fully insulated pipe covering.

B. Use adhesive and/or tape specified for type of insulation to insure a thorough vapor barrier.

C. Tape ends securely to adjacent pipe covering. Tape to extend over adjacent pipe insulation with an overlap of at least 2-inch on both sides.

3.7 PENETRATION OF RATED WALLS, PARTITIONS & FLOORS

A. Refer to other Sections on Firestopping. Do not pass pipe insulation through fire rated partitions or floors unless firestopping system is listed for insulated pipe. Stop and properly terminate insulation at each side of partition.

B. On systems operating below ambient temperature provide insulation compatible with UL listing of firestopping at penetration.

C. Stop all duct coverings, including jacket and insulation, at fire damper penetrations of walls, floors above grade and roofs.

D. Stop all duct coverings including jacket and insulation at all penetrations of rated walls and smoke partitions. Flare-out or extend insulation jacket at least 2-inches beyond angle frames of fire dampers and seal to structure.

E. Maintain vapor barrier.

F. Install covering over damper and smoke detector access doors readily removable and identifiable.

3.8 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

3.9 SAFETY PRECAUTIONS

A. Insulation Contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats, and eye protection.

B. The insulation contractor shall conduct all job site operations in compliance with

applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

3.10 FIELD QUALITY ASSURANCE

A. Upon completion of all insulation work covered by this specification, visually inspect the work and verify that it has been correctly installed. This may be done while work is in progress, to assure compliance with requirements herein to cover and protect insulation materials during installation.

3.11 INSULATION REPAIR

A. Repair damaged sections of mechanical insulation damaged during this construction period, including that damaged during installation of new devices or controls. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.

3.12 DUCTWORK SYSTEM INSULATION SCHEDULE

A. Insulate the following ductwork application with material and thickness as scheduled below:

Service	Material	Thickness
Concealed Supply Air Inside Building	Fiberglass Ductwrap	2” (min. R-5)
Supply and Return Duct within Building but not in Conditioned Space	Fiberglass Ductwrap	3” (min. R-8)

3.13 PIPING SYSTEM INSULATION SCHEDULE

A. Insulate the following piping systems with material and thickness as scheduled below: (Based on K=0.27 BTU-in/hr. ft2 F, adjust for other K values)

PIPING SYSTEM TYPES	FLUID TEMP RANGE, °F	INSULATION SPEC. TYPE	PIPE SIZES [a]					
			Runouts up to 1.5” [b]	<1”	1” to 1¼”	1½ to 3”	4” to 6”	8” and up
Refrigerant	40-110	E	1.5	1.5	1.5	1.5	1.5	1.5

END OF SECTION 230700

SECTION 232300 REFRIGERANT PIPING AND SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Extent of refrigerant piping work is indicated on drawings and by requirements of this section.

B. Insulation of refrigerant piping is specified in other Division-23 sections, and is included as work of this section.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of refrigerant piping products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. ANSI Compliance: Fabricate and install refrigerant piping in accordance with ANSI B31.5 "Refrigeration Piping", and extend applicable lower pressure limits to pressures below 15 psig.
2. ASHRAE Compliance: Fabricate and install refrigerant piping in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigerant".

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data for refrigerant piping materials and products.

B. Brazing Certification: Certify brazing procedures, brazers and operators in accordance with ASME standards (ANSI B31.5).

C. Record Drawings: At project closeout, submit record drawings of installed refrigerant piping and piping products, in accordance with requirements of Division 1.

D. Maintenance Data: Submit maintenance data and parts lists for refrigerant piping materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS:

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as determined by Installer to comply with installation requirements. Provide materials and products complying with ANSI B31.5 Code for Refrigeration Piping where applicable, base pressure rating on refrigerant piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in refrigerant piping systems. Where more than one type of materials or products are indicated, selection is Installer's option.

2.2 BASIC PIPES AND PIPE FITTINGS:

A. Tube Size 1" through 4": Copper tube; Type ACR, hard-drawn temper; wrought-copper, solder-joint fittings; brazed joints.

B. Tube Size ¾" and Smaller: Copper tube; Type ACR, soft annealed temper fittings; cast copper-alloy fittings for flared copper tubes; flared joints.

C. Brazed Joints: Braze joints using American Welding Society (AWS) classification BCuP-4 for brazing filler metal.

2.3 BASIC PIPE SPECIALTIES:

A. General: Provide specialties complying with Section 23 26 00 "Piping Specialties", in accordance with the following listing:

1. Pipe escutcheons.
2. Drip pans.
3. Sleeves.
4. Sleeve seals.

2.4 BASIC SUPPORTS AND ANCHORS:

A. General: Provide supports and anchors complying with Division-23 Basic Mechanical Materials and Methods section "Supports and Anchors", in accordance with the following listing:

1. Adjustable steel clevises, adjustable roller hangers, and adjustable pipe roll stands for horizontal piping hangers and supports.
2. Two-bolted riser clamps for vertical piping supports.
3. Concrete inserts, C-clamps, and steel brackets for building attachments.
4. Protection shields for insulated piping support in hangers.
5. Copper flashings for piping penetrations.

2.5 REFRIGERANT SPECIALTIES:

A. Refrigerant Strainers: Brass shell and end connections, brazed joints, monel screen, 100 mesh, UL-listed, 350 psi working pressure.

B. Moisture-Liquid Indicators: Forged brass, single port, removable cap, polished optical glass, solder connections, UL-listed, 200□F temperature rating, 500 psi working pressure.

C. Refrigerant Filter-Driers: Steel shell, ceramic fired desiccant core, solder connections, UL-listed, 500 psi working pressure.

D. Refrigerant Filter-Driers: Corrosion-resistant steel shell, steel flange ring and spring, wrought copper fittings, ductile iron cover plate with steel cap screws, replaceable filter-drier core, 500 psi working pressure.

E. Refrigerant Discharge Line Mufflers: Provide discharge line mufflers as recommended by equipment manufacturer for use in service indicated, UL-listed.

F. Acceptable Manufacturers: Subject to compliance with requirements, provide solenoid valves of one of the following:

1. Alco Control Div.; Emerson Electric Co.
2. Henry Valve Co.
3. Parker-Hannifin Corp.; Refrigeration & Air-Conditioning Div.
4. Sporlan Valve Co.

2.6 BASIC VIBRATION CONTROL:

A. General: Provide vibration control products in accordance with the following listing:

1. Riser isolators.
2. Riser support isolators.
3. Flexible pipe connectors.

PART 3 - EXECUTION

3.1 INSPECTION:

A. General: Examine areas and conditions under which refrigerant piping system materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF REFRIGERANT PIPING:

A. General: Install refrigerant piping in accordance with equipment manufacturer's recommendations.

B. Clean refrigerant piping by swabbing with dry lintless (linen) cloth, followed by refrigerant oil soaked swab. Remove excess oil by swabbing with cloth soaked in high flash point petroleum solvent, squeezed dry.

C. Bleed dry nitrogen through refrigerant piping during brazing operations.

3.3 INSTALLATION OF PIPING SPECIALTIES, SUPPORTS, AND ANCHORS:

A. Install piping specialties in accordance with requirements of respective Specification Section.

3.4 INSTALLATION OF SPECIAL REFRIGERANT VALVES:

A. General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions. Remove accessible internal parts before brazing, replace after joints are completed.

B. Solenoid Valves: Install in refrigerant piping as indicated with stem pointing upwards.

1. Wiring of solenoid valves is specified in applicable Division-26 sections, and is included as work of this section.
2. Wiring of solenoid valves is specified in applicable Division-26 sections, not work of this section.

3.5 INSTALLATION OF REFRIGERANT ACCESSORIES:

A. Refrigerant Strainers: Install in refrigerant lines as required, and in accessible location for service.

B. Moisture-Liquid Indicators: Install as required on refrigerant liquid lines, in accessible location.

C. Refrigerant Filter-Dryers: Install in refrigerant lines as required, and in accessible location for service.

D. Evaporator Pressure Regulators: Install in refrigerant suction lines or evaporator outlets as required. Adjust, if required, for proper evaporator pressure.

E. Refrigerant Discharge Line Mufflers: Install as required, in horizontal or downflow portion of hot-gas lines, immediately after leaving compressor; not in riser.

3.6 EQUIPMENT CONNECTIONS:

A. General: Connect refrigerant piping to mechanical equipment and comply with equipment manufacturer's instructions.

3.7 FIELD QUALITY CONTROL:

A. Refrigerant Piping Leak Test: Prior to initial operation, clean and test refrigerant piping in accordance with ANSI B31.5, "Refrigeration Piping". Perform initial test with dry nitrogen, using soap solution to test all joints. Perform final test with 27" vacuum, and then 200 psi using halide torch. System must be entirely leak-free.

B. Repair or replace refrigerant piping as required to eliminate leaks, and retest as specified to demonstrate compliance.

3.8 DEHYDRATION AND CHARGING SYSTEM:

A. Install core in filter dryer after leak test but before evacuation.

B. Evacuate refrigerant system with vacuum pump; until temperature of 35□F (2□C) is indicated on vacuum dehydration indicator.

C. During evacuation, apply heat to pockets, elbows, and low spots in piping.

D. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.

E. Break vacuum with refrigerant gas, allow pressure to build up to 2 psi.

F. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.

3.9 ADJUSTING AND CLEANING:

A. Cleaning and Inspecting: Clean and inspect refrigerant piping system in accordance with requirements of applicable section.

END OF SECTION 232300

SECTION 233100 DUCTWORK AND ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. The extent of the sheet metal work is indicated on the drawings and in the schedules, and by the requirements of this section. The types of ductwork and accessories specified in this section include but are not necessarily limited to the following:

1. Supply and return air systems.
2. General exhaust systems.
3. Turning vanes.
4. Access doors.
5. Flexible duct.
6. Flexible duct connections.
7. Duct test holes.
8. Volume control dampers.

1.2 QUALITY ASSURANCE

A. Manufacturers: Firm regularly engaged in the manufacture of duct accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

1. Acceptable manufacturers include:
   a. Semco
   b. United McGill
   c. United Sheet Metal
   d. Thermaflex (flexible ducts)

B. When the system is in operation, the ductwork shall be free from rattles and air noises caused by poor duct construction.

1.3 REFERENCES:

A. UL Labels: Provide flexible metal ducts and fiberglass ductwork and connectors which comply with the applicable portions of UL 181 and bear the label of Underwriters Laboratories.

B. UL 33 – Heat Responsive links for Fire-Protection Service.

C. UL 555 – Fire Dampers and Ceiling Dampers.

D. UL 555S -Smoke Dampers.

E. Industry Standards: Comply with SMACNA (Sheet Metal and Air Conditioning Contractor's National Association) recommendations for fabrication, construction and details, and installation procedures, except as otherwise indicated.

F. SMACNA "HVAC Duct Construction Standards Metal and Flexible" and “Industrial Duct Construction Standards”, Current Edition.

G. Comply with ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers) recommendations, except as otherwise indicated.

H. NFPA 90A – Installation of Air Conditioning and Ventilating Systems.

1.4 SUBMITTALS:

A. Product Data, Metal Ductwork: Submit manufacturer's data on duct lining insulation and ductwork accessories.

B. Shop Drawings, Ductwork Accessories: Submit dimensioned drawings of ductwork with accessories showing both accurately scaled accessories and their relationship to ductwork and space enclosure. Show modifications, of indicated requirements, if applicable, made to conform to local shop practice, and show how these modifications ensure that materials and weights are not reduced, and that the fabricated units are equivalent to the specified requirements.

1.5 PRODUCT HANDLING:

A. Protect shop fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. Where possible, store ductwork inside and protect from weather. Where necessary store outside, store above grade and enclosed with waterproof wrapping.

PART 2 - PRODUCTS

2.1 DUCTWORK:

A. General: Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated. Unless otherwise noted, pressure class shall be determined by fan rating.

B. Materials:

1. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lockforming quality; with G 90 zinc coating in accordance with ASTM A 525; and mill phosphatized for exposed locations

C. Low Velocity Ductwork: Shall be constructed of the sheet metal gauge and with end joints and reinforcing as per Table 1, "Duct Manual and Sheet Metal Construction", SMACNA Section 1.

D. Ductwork shall be constructed as indicated below:

1. Low Pressure Ductwork: Outside air intake, return air, relief air and exhaust air ducts having a semi-perimeter (height plus width) of 96 inches or less; supply ductwork downstream of pressure reducing dampers or air terminal units, to the air distribution devices, and supply ductwork on air handling systems having a total fan pressure of 2 inches W.G. or less shall be low pressure. Low pressure duct shall be constructed to meet SMACNA Pressure Class 2" and Seal Class "A".
2. Medium Pressure Ductwork: For single and dual duct CV or VAV systems, all supply ductwork upstream of pressure reducing dampers or air terminal units, and in systems with fan total pressure rating higher than 2", use medium or high pressure construction as applicable. Ducts shall meet SMACNA Pressure Class 4" and Seal Class A. On fans that exceed 4" TSP, construct duct in accordance with highest Pressure Class to be encountered for each system.

E. Duct Sealant: Use non-hardening, water resistant, fire resistive, non-migrating mastic or liquid elastic sealant as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork. Tape is not acceptable for use as duct sealant. Sealant shall be less than 30 g/L VOC content. Ductwork shall be constructed and sealed to comply with the following seal classes per SMACNA standards: Low Pressure Ductwork – Seal Class A.

F. Duct Fabrication: Duct sections shall be fabricated in maximum lengths of 8'-0" and shall conform to the sizes and routings shown, except that routing shall be changed and offsets provided by the contractor to avoid conflicts and/or obstructions encountered. Longitudinal seams in all ductwork shall be Pittsburgh locks. Ducts 12" wide and larger shall be cross broken. Duct fittings, connections, damper locations and construction, etc., shall be as indicated on the drawings. Details of construction not specifically shown or specified shall be as indicated on the SMACNA "Duct Manual and Sheet Metal Construction" Sections 1 and 2.

1. Change in the cross-sectional dimensions of ductwork is permissible when required to meet job conditions. Maintain at least the same equivalent cross-sectional duct area in accordance with the latest edition of the ASHRAE Guide. Secure the approval of the Professional prior to fabrication of ductwork requiring such changes.
2. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Change duct sizes gradually, not exceeding 15 degrees wherever possible. Limit angular tapers to 45 degrees for contracting tapers and 30 degrees for expanding tapers.
3. Where space permits, construct elbows with a minimum centerline radius to duct width ratio (r/W) of 1.5. Where space is limited, use curved elbows with splitter vanes spaced per SMACNA standards. Where r/W ratio can be between 0.75 and 1.0, 1 splitter vane may be used. Where r/W ratio must be

between 0.70 and 0.60, 2 splitter vanes shall be used. If r/W ratio must be less than 0.60, then use 3 splitter vanes. Mitered elbows with turning vanes shall not be permitted.

4. If connection size equals or exceeds 25% of main size, use SMACNA Figure 2-7 "Parallel Flow Branches.
5. For small branch connections other than above, use either low-loss rectangular 45 degree entry, conical or bellmouth fittings per SMACNA Figure 2-8, "Branch Connections." Straight spin-in fittings are not acceptable. Where above "accessible" ceiling construction, the connection fittings shall contain the branch balancing damper.
6. All ductwork must present a smooth interior and joints must be effectively airtight.
7. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Prime coat welded joints with zinc-rich paint

G. All round and/or flat oval spiral duct and fittings shall be manufactured by a company whose primary business is the manufacture of spiral duct and fittings. All spiral duct and fittings shall be manufactured by the same firm and shall be as shown on the contract drawings. All spiral duct and fittings shall be manufactured from G-90 paintgrip verify paintgrip required on job galvanized steel meeting ASTM-A924 and A653 requirements.

H. Construction.

1. Branch connections shall be made with 90° conical and 45° straight taps as shown on the drawings. All branch connections shall be made as a separate fitting. Factory or field installation of taps into spiral duct shall not be allowed.
2. All 90° and 45° elbows in diameters 3" round through 10" round shall be stamped or pleated elbows. All other elbows shall be of the gored type, fabricated in accordance with the following.

	Centerline Radius	Elbows Less than 30°	Elbows 37°thru 71°	Elbows 72°thru 90°
Up to 1000 fpm	1.0 x diameter	2 gores	2 gores	3 gores
1001 to 1500 fpm	1.0 x diameter	2 gores	3 gores	4 gores
Above 1500 fpm	1.5 x diameter	2 gores	3 gores	5 gores

Where it is necessary to use two-piece mitered elbows, they shall have a minimum number of vanes in accordance with the following:

DUCT DIAMETER	NUMBER OF VANES
3” thru 9”	2
10” thru 20”	3
21” and up	5

3. Circumferential and longitudinal seams of all fittings shall be a continuous weld or spot welded and sealed with mastic. All welds shall be painted to prevent corrosion.

4. All field joints for round ducts up to and including 36" diameter and oval ducts up to and including 41" major axis shall be made with a 2" slip-fit or slip coupling. Diameters 38" round and larger shall be provided flanged connections. Flanged connections may also be used in lieu of slip connections on smaller sizes.
    a. Access doors shall be supplied by the duct manufacturer at all fire and/or smoke dampers.
    b. All flanges and access doors shall be factory installed.

I. Metal Gauges:

1. Metal gauges for single wall round ducts shall be as follows.

    a. Round Ducts with Maximum 2" W.G. Positive Static Pressure

DUCT DIAMETER	SPIRAL DUCT	FITTINGS AND LONGITUDINAL SEAM DUCT
3” thru 26”	26	24
28” thru 36”	24	22
38” thru 50”	22	20
52” thru 60”	20	18
62” thru 78”	18	16

    b. Round Ducts with Maximum -2” W.G. Negative Static Pressure

DUCT DIAMETER	SPIRAL DUCT	FITTINGS AND LONGITUDINAL SEAM DUCT
3” thru 17”	26	24
18” thru 20”	24	22
21” thru 22”	24	20
24” thru 26”	22	20
28” thru 30”	22	18
32” thru 34”	20	18
36” thru 42”	20	16
44” thru 48”	20	18 (Note 1 & 3)
50” thru 60”	18	18 (Note 1 & 3)

Notes:
1. Reinforce with 1" x 1" x 1/8" girth rings every 6 ft.
2. Reinforce with 1 ¼ " x 1 ¼ " x 3/16 " girth rings every 4 ft.
3. When companion flange joints are used as reinforcement,
   44" to 48" diameter shall be 2" x 2" x 3/16”
   50" to 60" diameter shall be 2 ½ x 2 ½ x 3/16”

J. No product containing any amount of any form of asbestos shall be installed on this project. Asbestos includes but is not limited to asbestiform varieties of chrysotile, crocidolite, anthoplyllite, tremolite or actinolite. The contractor shall furnish a letter to the Owner certifying that this requirement has been complied with prior to final payment.

2.2 FLEXIBLE RUNOUTS:

A. Non-Insulated Low Pressure Flexible Ducts: Shall be UL-181 Class 1 flexible air duct, complying with NFPA Standards 90A and 90B. Duct shall be factory fabricated of a coated spring wire helix permanently bonded to a coated woven fiberglass cover.

1. Operating Pressure Rating: Minimum 10” positive (2-14 inch diameter), 1” negative (2-14 inch diameter).
2. Maximum Velocity: 2500 fpm
3. Operating Temperature: 0 to 180
4. Maximum Flame Spread/Smoke Developed ratings: 25/50

B. Insulated Low Pressure Flexible Ducts: Shall be UL-181 Class 1 flexible air duct, complying with NFPA Standards 90A and 90B. Duct shall be factory made and composed of a CPE liner duct permanently bonded to a coated spring wire helix supporting a fiberglass scrim and fiberglass insulating blanket with a low permeability outer vapor barrier jacket.

1. Operating Pressure Rating: Minimum 4” positive (3-20 inch diameter), 1” negative (3-12 inch diameter), 0.5” negative (14-20 inch diameter)
2. Maximum Velocity: 2500 fpm
3. Operating Temperature: -0 to 180
4. Minimum R value: 4.2
5. Maximum Flame Spread/Smoke Developed ratings: 25/50

C. Insulated Medium Pressure Flexible Ducts: Shall be UL-181 Class 1 flexible air duct, complying with NFPA Standards 90A and 90B. Duct shall be factory made and composed of a CPE liner duct permanently bonded to a coated spring wire helix supporting a fiberglass scrim and fiberglass insulating blanket with a low permeability outer vapor barrier jacket.

1. Operating Pressure Rating: Minimum 6” positive (4-16 inch diameter), 4” positive (18-20 inch diameter), 1” negative (4-12 inch diameter), 0.5” negative (14-20 inch diameter)
2. Maximum Velocity: 5000 fpm
3. Operating Temperature: -20 to 200
4. Minimum R value: 4.2
5. Maximum Flame Spread/Smoke Developed ratings: 25/50
6. Acceptable Manufacturers:
    a. Thermaflex – G-KE or approved equivalent.

D. Flexible connectors (with SMACNA label indicating compliance with UL 181 or not) are not acceptable as substitution for flexible duct.

2.3 DAMPERS:

A. Shall be substantially constructed and installed to provide proper operation and structural rigidity under the velocity and full static pressures to which the damper is subject. Multi-section dampers shall be assembled into a structural angle or channel iron frame welded together and securely anchored to the structure and arranged so that each damper section bolts to a structural framing member rather than to an adjacent damper section. Detailed drawings of the assembly shall be submitted for review prior to installation. Motors and motor linkage to damper for motor operated dampers and damper assemblies shall be provided under the Automatic Controls Section and shall be submitted for review prior to installation.

B. Two-Position Dampers: Shall be parallel or opposed blade type with solid continuous stops on all sides and with blades fabricated of 16 gauge galvanized steel and with angle or channel steel frames. Blades shall be interlocking type not less than 6 inches in width and shall be provided with zinc plated steel bearing pins, bronze oilite bearings, and with required ball joint linkages. Damper and frame to be furnished in rust resistant coating or shall be hot-dipped galvanized.

C. Proportioning and Mixing Dampers: Shall be of the opposed blade type with "low leakage" construction.

D. Outside Air Intake, Metering Type, Pressure Reducing Dampers (not specified or scheduled on the drawings as part of manufactured product): Shall be opposed blade type with 6-inch blades formed from two thicknesses of 22 gauge galvanized steel spot welded together. Damper frames shall be channel type and frames and blades shall be provided with a tight seal consisting of a continuous, replaceable, butyl rubber seal on top, bottom, sides and along each blade edge. Bearings shall be nylon with stainless steel bushings. Linkage shall be galvanized steel located within the damper frame. Motor linkage to damper shall be equal percentage type. Air loss or leakage when dampers are fully closed shall not exceed 2% of the total flow at 6 inches W. G. Published data certifying performance shall be submitted.

E. Manual Volume Dampers: Up through 12 inches in height shall be shop fabricated single blade "butterfly dampers". The blade shall be fabricated of 18 gauge galvanized steel reinforced to make rigid. Manual volume dampers exceeding 12 inches in height shall be opposed blade dampers, as specified for automatic dampers, with manual operator. Provide a locking quadrant and set screw for all manual dampers.

1. Manual volume and splitter dampers shall be furnished where shown and where necessary for proper regulation of the air distribution. No grille dampers shall be used for balancing.

2.4 TURNING VANES:

A. Provide turning vanes in the size and type indicated with the following additional construction features:

1. Blades: 2" galvanized steel for up to and including 18" ducts, 4 1/2" galvanized steel for ducts over 18”.
2. Construction: Single wall blade.
3. Types: Fixed blades for 90 degree elbows.

2.5 EXTRACTIONS:

A. Provide extractors in size and type indicated, with hex-key operated adjustable blades, with the following additional construction features:

1. Blades: Gang-operated galvanized steel on 1" centers.

2.6 DUCT ACCESS DOORS:

A. General: Provide access doors at all locations of duct systems requiring service access including but not necessarily limited to: smoke dampers, fire dampers, smoke detectors, humidifiers, control accessories, tops and bottoms of risers for cleaning. Access doors shall close with air pressure. All access doors are to be fully accessible without obstruction.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, use double-wall construction with insulation between.

D. Access doors smaller than 12 inches square may be secured with sash locks.

E. Provide two hinges and tow sash licks for sizes up to 18 inches square, three hinges and tow compression latches with outside and inside handles for sizes up to 24 x 48 inches. Provide an additional hinge for larger sizes.

F. Access doors with sheet metal screw fasteners are not acceptable.

2.7 DUCT TEST HOLES:

A. Fabricate in accordance with SMACNA Duct Construction Standards, and as indicated.

B. UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 20 oz. per sq. yd., approximately 2 inches wide, crimped into metal edging strip.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION:

A. General: Assemble and install ductwork in accordance with recognized industry practices which will be in accordance with the leakage rates allowable for specified seal class, with no objectionable noise, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor. The internal surfaces of all ductwork shall be smooth. No sheet metal parts, tabs, angles, etc. may project into ducts unless specified to do so. All seams and joints shall be external.

B. Installation of flexible runouts shall comply with Section 303 (a) of NFPA 90A.

1. Limit length to 5', unless otherwise specifically shown otherwise on drawings.
2. Supply air systems: Use insulated flexible ducts of applicable pressure ratings.
3. Return, Exhaust air systems: Use non-insulated flexible ducts.
4. Connect flexible ducts to metal ducts with adhesive and draw bands. On systems with positive pressure over 2", secure tightened bands in place with sheet metal screws.

C. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements. Where possible, ductwork shall be fabricated in such a manner that seams and/or joints will not be cut for the installation of grilles, registers, or ceiling outlets. If cutting of seams or joints is unavoidable, the cut portion shall be properly reinforced to original strength.

D. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to ½" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

E. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

1. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal cam with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
2. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

F. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.

1. All ductwork shall be properly suspended or supported from the building structure. The duct hanging system is composed of three elements; the upper attachment to the building structure, the hanger itself and the lower attachment to the duct. The attachments, hangers and supports for all ductwork shall be in accordance with Section IV of the SMACNA Manual. Ductwork shall be seismically restrained as required by Code.
    a. Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

3.2 DUCT SUPPORTS:

A. Horizontal rigid ductwork shall be supported at not more than 8 feet o.c. and at each change of direction. Hangers shall be 1/4 inch all thread rod and angle iron securely attached to ductwork and to the structure. Ductwork shall be "sway-braced" to prevent longitudinal movement. Vertical duct risers shall be supported at each floor by angles or channels secured to the duct at the floor arranged to prevent conflicts with fire damper access. All exposed angles and metal surfaces less than ten (10) feet above the floor shall be beveled, flattened or ground smooth to prevent injury to pedestrians.

B. Support flexible ductwork with threaded galvanized steel rods secured to the structure above and connected at the duct by 1-1/4" wide (min.) X 20 Ga. galvanized steel bands double-hemmed at threaded rod attachment. Thru-bolt the band at the threaded hanger rod, with locknuts. Provide insulation shield between the duct insulation and the band of a length adequate to prevent compressing the insulation more than 1/4".

C. Provide hangers as required to prevent sagging of the duct.

3.3 DUCTWORK LEAKAGE TESTS:

A. It is essential that all air ductwork be practically air tight. There will be no requirement for formal duct leakage tests with apparatus for ducts with a design operating pressure of 3 in wg or less. However, before being insulated or concealed, all ducts, shall be checked for leakage. The Contractor shall schedule a field observation with the Engineer before insulation is applied in order for the

Engineer to review and accept the work. Any deficiencies causing noticeable leakage (noise or detected air movement) shall be corrected.

B. Duct systems with greater than 3 in. wg design operating pressure shall be leak tested in accordance with the SMACNA HVAC Air Duct Leakage Test Manual. Maximum duct leakage shall be per C403.2.9.1.3 of the 2018 NC Energy Conservation Code.

3.4 FLOOR/WALL PENETRATIONS:

A. Where ducts pass through non fire-rated interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1½". Fasten to duct and substrate.

B. Where ducts pass through sound rated interior partitions, provide 16 gauge sheet metal sleeve in wall allowing 1" clearance all around. Pack annular space with fibrous material and seal all around both sides with a sealant that will remain flexible. In areas where exposed to view, provide flanges as described above.

C. Where ducts pass through fire-rated floor, walls, or partitions, provide fire dampers in accordance with requirements of Section 15910. The space between the duct and wall shall be packed with Dow Corning 3-6548 Silicone RTV foam and secured with a sheet metal closure collar or not less than 2-inch width the same gage metal as the duct. Hinged access panels shall be provided at each fire damper and automatic damper, and at each elbow with turning vanes and splitter damper. Panels shall be 18" x 18" (min.) unless indicated otherwise. Where size of duct will not accommodate this size, the panels shall be as large as practical, but not less than 12" x 12". Panels in insulated duct shall be insulated type. Flexible connections in ductwork shall be accordance with Section 15070.

D. Where ducts pass through non-fire-related, designated smoke partitions, completely seal penetration against the passage of smoke in accordance with the requirements of the authority having jurisdiction.

E. Seal penetrations of the building surfaces, including the vapor barrier, with materials compatible with both the building materials and the ductwork outer surface.

3.5 ACCESSORIES INSTALLATION:

A. Install accessories in accordance with manufacturer’s instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated. Provide

minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Where access door is for a smoke detector, access door shall be upstream of device to facilitate testing.

D. Provide duct test holes where indicated and required for testing and balancing purposes. Seal with neoprene plugs.

E. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

F. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

G. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

H. Coordinate installation so that all operable devices are accessible.

I. All penetrations of a return air duct in the vicinity of smoke detectors installed on or in an air duct shall be sealed to prevent entrance of outside air and possible dilution or redirection of smoke within the duct.

3.6 IDENTIFICATION:

A. Provide ductwork and accessory identification per Section 230553.

3.7 TEMPORARY CLOSURE:

A. Temporary Closure: At all ends of ducts provide temporary closure of polyethylene film or other covering which will prevent entrance of dust, paint overspray and debris until time connections are to be completed. Maintain closures until dust producing activities have ceased and building has been cleaned. Contractor is responsible for means and methods to deliver a clean, like new air system. Should project conditions require measures beyond what is specifically called for to achieve this, contractor is responsible for identifying and providing same at no additional cost to the owner.

END OF SECTION 233100

SECTION 233400 FANS

PART - 1 GENERAL

1.1 SECTION INCLUDES

A. The HVAC Contractor shall provide complete and operational fans as indicated on drawings and schedules, and by requirements of this section. Fans shall have direction of rotation, discharge direction, arrangement to suit space conditions and generally conform to the layouts shown on the drawings.

B. Types of fans required for project include the following:

1. Power roof ventilators.
2. In line centrifugal fans

1.2 QUALITY ASSURANCE

A. General

1. Guarantee all fans to fulfill the specified requirement at or below the specified sound levels.
2. Size each fan motor to drive its respective fan when fan is operating at a speed (due to pulley adjustment) of 5 percent in excess of that required to meet fan performance. Do not select motor within the service factor range.

B. Codes and Standards

1. AMCA Compliance: Provide centrifugal fans bearing the AMCA Certified Ratings Seal. Sound rate centrifugal fans in accordance with AMCA 300 "Test Code for Sound Rating Air Moving Devices".
2. ASHRAE Compliance: Test and rate centrifugal fans in accordance with ASHRAE 51 (AMCA 210) "Laboratory Methods of Testing Fans for Rating".
3. UL Compliance: Provide centrifugal fan electrical components which have been listed and labeled by UL.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for centrifugal fans, including specifications, capacity ratings, fan performance curves with operating point clearly indicated, gages and finishes of materials, dimensions, weights, accessories furnished, and installation instructions. Also include certified sound power ratings with an octave band analysis.

B. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to fan units. Submit manufacturer's ladder-type wiring diagrams for interlock

and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

C. Maintenance Data: Submit maintenance instructions, including lubrication instructions, motor and drive replacement, and spare parts lists. Include this data, product data, shop drawings, and wiring diagrams in maintenance manuals; in accordance with requirements of Section 23 05 00.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver centrifugal fans with factory-installed shipping skids and lifting lugs; pack components in factory-fabricated protective containers.

B. Handle centrifugal fans carefully to avoid damage to components, enclosures, and finish. Do not install damaged components; replace and return damaged components to centrifugal fan manufacturer.

C. Store centrifugal fans in clean dry place and protect from weather and construction traffic.

D. Comply with manufacturer's rigging and installation instructions for unloading centrifugal fans, and moving them to final location.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL CEILING EXHAUSTERS

A. General: Provide centrifugal ceiling exhauster of type, size and capacity as scheduled.

B. Type: Provide galvanized steel housing lined with acoustical insulation. Provide centrifugal fan wheels mounted on motor shaft with fan shrouds, all removable for service. Provide integral backdraft damper on fan discharge.

C. Electrical: Provide factory-wired junction box for electrical connection on housing and receptacle for motor disconnect. Provide thermal overload protection in fan motor. Refer to Section 23 05 03 for motors. Provide cabinet mounted fan speed control.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fans which may be incorporated in the work include, but are not limited to, the following:

1. Aerovent
2. Cook (Loren)
3. Greenheck

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which fans are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF FANS

A. General: Install fans where indicated, in accordance with manufacturer's installation instructions, and with recognized industry practices, to ensure that fans comply with requirements and serve intended purposes.

B. Access: Provide access and service space around and over fans as indicated, but in no case less than that recommended by manufacturer.

C. Isolation: Install fans on vibration isolators, fasten in accordance with manufacturer's installation instructions.

D. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Ensure that rotation is in direction indicated and intended for proper performance. Do not proceed with fan start-up until wiring installation is acceptable to fan Installer.
2. Provide and connect all necessary controls to ensure proper sequence of operations as shown on plans and details.

E. Ductwork Connections: Refer to Division-23 "Ductwork" sections. Provide flexible connections on inlet and outlet duct connections.

1. Provide access door in duct below power roof ventilators to service damper.

F. Protect belts, sheaves, bearings, motors and other fan parts during installation.

G. Identification: Provide plastic equipment markers per Specification 23 05 53.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation of fans, and after motor has been energized with normal power source, test equipment to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment which cannot be satisfactorily corrected.

3.4 ADJUSTING AND CLEANING

A. Start-up, test, and adjust fans in presence of manufacturer's authorized representative.

B. Check belt tension and pulley alignment and adjust as required.

3.5 SPARE PARTS

A. General: Furnish to owner, with receipt, one spare set of belts for each belt driven fan.

END OF SECTION 233400

SECTION 233700 AIR DISTRIBUTION DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. The extent of air distribution devices is indicated on the drawings and by the requirements of this section for supply, return and exhaust diffusers, grilles and registers.

1.2 REFERENCES:

A. ARI 650 – Air Inlets and Outlets.

B. ASHRAE 70 – Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.

C. SMACNA – HVAC Duct Construction Standard – Metal and Flexible.

1.3 QUALITY ASSURANCE:

A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.

B. Manufacturers: Firms regularly engaged in the manufacture of air distribution devices of the types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

C. Manufacturers: Provide products produced by one of the following:

1. Krueger
2. Metalaire
3. Titus
4. Price
5. Nailor

D. NFPA Compliance: Comply with the National Fire Protection Association Standard No. 90, as applicable to air distribution device construction and installation.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets in a manner to facilitate convenient review including the following:

1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.

B. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver air units wrapped with waterproof wrapping in factory-fabricated fiberboard type containers. Store air units in original cartons and protect from weather and construction work traffic.

B. Avoid crushing or bending diffusers, and prevent dirt and debris from entering and settling in diffusers.

PART 2 - PRODUCTS

2.1 REGISTERS, GRILLES AND DIFFUSERS:

A. General: Except as otherwise indicated, provide manufacturer's standard air distribution devices where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide devices that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Compatibility: Provide air distribution devices with border styles that are compatible with adjacent systems, and that are specifically manufactured to fit into construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of construction that will contain each type air distribution device.

D. Types: Provide air distribution devices of type, capacity, and with accessories and finishes as listed on schedule.

E. Mounting: Provide as scheduled on the drawings. Manufacturer’s air outlet data shall be based on Air Diffusion Council (ADC) standards. All screw holes in flanges shall be countersunk and secured with flathead screws. All air outlets shall be provided with sponge rubber gaskets. All parts of air distributing outlets and inlets shall be securely held to the ceiling, wall, and/or ducts. Exercise all possible care to prevent outlets and inlets from disengaging. Provide any additional angles and braces that are required to make a “fall proof” installation.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Install devices in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve the intended function.

B. Coordinate with other work, including ductwork and ductwork accessories, as necessary to interface installation of air distribution devices properly with other work.

C. Connect air devices to ductwork with air-tight connection.

D. Provide air balancing dampers in duct take-off to diffusers, registers and grilles despite whether or not dampers are specified as part of the air device assembly.

E. Support air distribution device independently of ceiling with 2 support wires (minimum size 12 gauge) on opposite sides or corners. Where there are attachment points on air distribution device they shall be utilized. Where there are no attachment points attach wires to ceiling grid.

F. Locate ceiling devices where indicated on architectural reflected ceiling plans. Center devices within acoustical tile ceiling modules.

3.2 FIELD QUALITY CONTROL:

A. Test operation of installed air distribution devices to demonstrate compliance with the requirements.

END OF SECTION 233700

SECTION 233718 EXTRUDED ALUMINUM STATIONARY LOUVERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Extruded aluminum stationary louvers with drainable blades.

1.2 REFERENCES

A. AAMA 605.2 - High Performance Organic Coatings on Architectural Extrusions and Panels.

B. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

C. AMCA 511 - Certified Ratings Program for Air Control Devices.

1.3 SUBMITTALS

A. Comply with requirements of Section 15010 - Submittal Procedures.

B. Product Data: Submit manufacturer's product data including performance data.

C. Shop Drawings: Submit shop drawings indicating materials, construction, dimensions, accessories, and installation details.

D. Samples: Submit sample of louver to show frame, blades, bird screen, gutters, downspouts, vertical supports, sill, accessories, finish, and color.

1.4 QUALITY ASSURANCE

A. Louvers licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance and water penetration ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

B. Storage: Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.

C. Handling: Protect materials and finishes during handling and installation to prevent damage.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements manufacturers offering louvers which may be used in the construction include the following:
   1. Ruskin Manufacturing
   2. Arrow
   3. Construction Specialties
   4. Industrial Louvers

2.2 EXTRUDED ALUMINUM STATIONARY LOUVERS

A. Fabrication:

   1. Model: ELF375DX.
   2. Performance Ratings: AMCA licensed.
   3. Frame:
      a. Material: Extruded aluminum, Alloy 6063-T5.
      b. Wall Thickness: 0.081 inch, nominal.
      c. Depth: 4 inches.
      d. Downspouts and caulking surfaces.
   4. Blades:
      a. Style: Drainable.
      b. Material: Extruded aluminum, Alloy 6063-T5.
      c. Wall Thickness: 0.081 inch, nominal.
      d. Angle: 37.5 degrees.
      e. e.Centers: 5-29/32 inches, nominal.
   5. Bird Screen:
      a. Material: Aluminum, 1/2 inch mesh x 0.063 inch, intercrimp.
      b. Frame: Removable, rewireable.
   6. Gutters: Drain gutter in head frame and each blade.
   7. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade.
   8. Vertical Supports: Hidden vertical supports to allow continuous line appearance up to 120 inches.

9. Sill: Steeply angled integral sill eliminating areas of standing or trapped moisture where mold or mildew may thrive and effect indoor air quality.

10. Assembly: Factory assemble louver components. All welded construction.

B. Performance Data:

1. Based on testing 48 inch x 48 inch size unit in accordance with AMCA 511.
2. Free Area: 54 percent, nominal.
3. Free Area Size: 9.08 square feet (0.84 m^2).
4. Maximum Recommended Air Flow Thru Free Area: 1,023 feet per minute.
5. Air Flow: 9,289 cubic feet per minute.
6. Maximum Pressure Drop: 0.15 inches w.g.
7. Water Penetration: Maximum of 0.01 ounces per square foot of free area at an air flow of 1,023 feet per minute free area velocity when tested for 15 minutes.

2.3 FACTORY FINISH

A. Color Anodize Finish:

1. Comply with Aluminum Association AA-C22A44.
2. Apply finish following chemical etching and pretreatment.
3. Electrolytically deposited color anodized finish.
4. Minimum Thickness: 0.7 mils (0.018 mm).

B. Clear Anodize Finish:

1. Comply with Aluminum Association AA-C22A41. Clear anodize finish 215-R1.
2. Apply finish following chemical etching and pretreatment.
3. Minimum Thickness: 0.7 mils (0.018 mm), 60 minute anodizing process.

PART 3 EXECUTION

3.1 EXAMINATION

A. Inspect areas to receive louvers. Notify the Engineer of conditions that would adversely affect the installation or subsequent utilization of the louvers. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install louvers at locations indicated on the drawings and in accordance with manufacturer's instructions.

B. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.

C. Install joint sealants as recommended by manufacturer.

3.3 CLEANING

A. Clean louver surfaces in accordance with manufacturer's instructions.

END OF SECTION 223718

SECTION 237300 AIR HANDLING UNITS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of air handling unit work is indicated on drawings and schedules and by requirements of this section.

B. All electrical components shall comply with Section 23 05 03 Electrical Requirements of Mechanical Work.

C. Types of packaged air handling units required for the project include the following”

1. Modular Indoor Central Air Handling Units.

1.2 REFERENCES:

A. AMCA 300 - Reverberant Method for Sound Testing of Fans.

B. AMCA 301 - Method for Publishing Sound Ratings for Air Moving Devices.

C. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

D. ANSI/UL 900 - Test Performance of Air Filter Units.

E. ARI 260 - Standard for Sound Rating of Ducted Air Moving and Conditioning Equipment.

F. ARI 410 - Standard for Forced Circulation Air-Cooling and Air-Heating Coils.

G. ARI 430 - Standard for Central Station Air Handling Units.

H. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedure for Fans.

I. ASTMB 117 - Standard Practice for Operation Salt Spray Apparatus.

J. NEMA MG1 - Motors and Generators.

K. NFPA 90 A & B - Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems.

L. SMACNA - HVAC Duct Construction Standards.

M. UL 1995 - Heating and Cooling Equipment.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of packaged air handling units with characteristics, sizes and capacities required, whose products have been in satisfactory use in similar service for not less that 5 years.

1. Manufacturers shall have ISO 9001 Certification

B. Codes and Standards:

1. AMCA Compliance: Test and rate air handling units in accordance with (AMCA) standards 210 and 500.
2. Air Coils: Certify capacities, pressure drops and selection procedures in accordance with current ARI 410 Standard.
3. ARI Compliance: Test and rate air handling units in accordance with ARI 430 "Standard for Central-Station Air Handling Units", display certification symbol on units of certified models.
4. NFPA Compliance: Provide air handling unit internal insulation having flame spread rating not over 25 and smoke developed rating no higher than 50; and complying with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".
5. UL and NEMA Compliance: Provide electrical components required as part of air handling units, which have been listed and labeled by UL and comply with NEMA Standards.
6. NEC Compliance: Comply with National Electrical Code (NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of air handling units.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data for air handling units showing dimensions, weights, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, gauges and finishes of materials and installation instructions.

B. Shop Drawings: Submit assembly-type show drawings showing unit dimensions, weight loadings, required clearances, construction details and field connection details.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to air handling units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement and spare parts lists. Include this data, product data, shop drawings and wiring diagrams in maintenance manuals; in accordance with requirements of Division 1.

E. Submittals shall identify manufacturer and model of dampers being furnished.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver air handling units with factory-installed shipping skids and lifting lugs; pack components in factory-fabricated protective containers.

B. Units shall ship fully assembled up to practical shipping and rigging limitations. Units not shipped fully assembled shall have tags and airflow arrows on each section to indicate location and orientation in direction of airflow. Shipping splits shall be clearly defined on submittal drawings. Cost associated with non conformance to shop drawings shall be the responsibility of the manufacturer. Each section shall have lifting lugs or shipping skid to allow for field rigging and final placement of section.

C. Deliver units to jobsite with fan motor(s), sheave(s), and belt(s) completely assembled and mounted in units.

D. Handle air handling units carefully to avoid damage to components, enclosures and finish. Do not install damaged components; replace and return damaged components to air handling unit manufacturer.

E. Store air handling units in clean dry place and protect from weather and construction traffic.

F. Comply with Manufacturer's rigging and installation instructions for unloading air handling units and moving them to final location.

1.6 START-UP AND OPERATING REQUIREMENTS:

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters in place, bearings lubricated (if applicable), condensate properly trapped, piping connections verified and leak-tested, belts aligned and tensioned, all shipping braces removed, bearing set screws torqued, and fan has been test run under observation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide air handling units of one of the following:

1. Trane: Climate Changer UCCA
2. Daiken McQuay Inc.: Vision
3. Carrier

2.2 GENERAL:

A. General: Provide factory-prefabricated and factory-tested air handling units as indicated, of sizes and capacities as and as specified herein.

B. Unit layout and configuration shall be as defined in project plans and schedule.:

2.3 UNIT CASING:

A. The entire air handler shall be constructed of galvanized steel. Casing finished to meet ASTM B117 250-hour salt-spray test. The removal of access panels or access doors shall not affect the structural integrity of the unit. All removable panels shall be gasketed. All doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be responsible to provide connection flanges and all other framework that is needed to properly support the unit.

B. All panels shall be 2-inch double wall construction to facilitate cleaning of unit interior. Casing deflection shall not exceed .005-inch deflection per linear foot under negative or positive pressure, up to unit casings maximum design limit of pressure.

C. Unit floor shall be of sufficient strength to support 300-lb load during maintenance activities, and shall deflect no more than .005-inches when sitting on a support structure.

D. Panel insulation shall provide a minimum thermal resistance (R) value of 13 ft^2*h*F/Btu throughout the entire unit. Insulation shall completely fill the panel cavities in all directions so that no voids exist and settling of insulation is prevented. Panel assembly shall comply with NFPA 90A.

E. Access panels and/or access doors shall be provided in all sections to allow easy access to drain pan, coil(s), motor, drive components and bearings for cleaning, inspection, and maintenance.

F. Access panels and doors shall be fully removable without the use of specialized tools to allow complete access of interior surfaces.

2.4 ACCESS DOORS:

A. Access doors shall be 2-inch double-wall construction. Interior and exterior shall be of the same construction as the interior and exterior wall panels.

B. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage.

C. Door hardware shall be surface-mounted to prevent through-cabinet penetrations that could likely weaken the casing leakage and thermal performance.

D. Handle hardware shall be designed to prevent unintended closure.

E. Access doors shall be hinged and removable without the use of specialized tools to allow.

F. All doors shall be a 60-inch high when sufficient unit height is available, or the maximum height allowed by the unit height.

2.5 PRIMARY DRAIN PANS:

A. The drain pan shall be designed in accordance with ASHRAE 62.1 being of sufficient size to collect all condensation produced from the coil and sloped in two planes, pitched toward drain connections, promoting positive drainage to eliminate stagnant water conditions when unit is installed level and trapped per manufacturer's requirements. The outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition. Drain pan shall be stainless steel.

B. All drain pan connections shall be visible external to the unit. Threaded connections under the unit floor shall not be accepted.

C. Drain connections shall be of the same material as the primary drain pan and shall extend beyond the base to ensure adequate room for field piping of condensate traps.

D. The installing contractor is responsible to ensure the unit is installed level, trapped in accordance with the manufacturer's requirements, and visually inspected to ensure proper drainage of condensate.

2.6 FANS:

A. Fan sections shall have a minimum of one hinged and latched access door located on the drive side of the unit to allow inspection and maintenance of the fan, motor, and drive components.

B. Provide fans of type and class as specified on the schedule. Fan shafts shall be solid steel, coated with a rust-inhibiting coating, and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM.

C. All fans, including direct drive plenum fans shall be internally isolated to inhibit noise and vibration through the ductwork and building structure. A flexible connection shall be installed between the fan and unit casing to ensure complete isolation. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor in order to avoid transmission of noise and vibration through the ductwork and building structure.

D. Belt-driven fans shall be provided with self-aligning, anti-friction bearings selected for L-50 200,000-hour average life per ANSI/AFBMA Standard 9.

2.7 MOTORS AND DRIVES:

A. All motors and drives shall be factory-installed and run tested. All motors shall be installed on a slide base to permit adjustment of belt tension. Slide base shall be designed to accept all motor sizes offered by the air-handler manufacturer for that fan size to allow a motor change in the future, should airflow requirements change. Fan sections without factory-installed motors shall have motors field installed by the contractor. The contractor shall be responsible for all costs associated with installation of motor and drive, alignment of sheaves and belts, run testing of the motor, and balancing of the assembly.

B. Motors shall meet or exceed all NEMA Standards Publication MG 1 - 2006 requirements and comply with NEMA Premium efficiency levels when applicable. Motors shall comply with applicable requirements of NEC and shall be UL Listed.

C. Fan Motors shall be heavy duty, open drip-proof. If applicable, motor efficiency shall meet or exceed NEMA Premium efficiencies.

D. All fan types shall use NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F (40 deg C) without tripping overloads.

E. Motors shall have a +/- 10 percent voltage utilization range to protect against voltage variation.

F. V-Belt drives for housed fans shall be fixed pitch rated at 1.5 times the motor nameplate. Drives 20 hp and larger or any drives on units equipped with VFDs and housed fans shall be fixed pitch.

G. All housed fans with motors 15 hp and larger shall be equipped with multiple belt drives.

2.8 COILS:

A. Coils section header end panel shall be removable to allow for removal and replacement of coils without impacting the structural integrity of the unit.

B. Install coils such that headers and return bends are enclosed by unit casing to ensure that if condensate forms on the header or return bends, it is captured by the drain pan under the coil.

C. Coils shall be manufactured with plate fins to minimize water carryover and maximize airside thermal efficiency. Fin tube holes shall have drawn and belled collars to maintain consistent fin spacing to ensure performance and air pressure drop across the coil as scheduled. Tubes shall be mechanically expanded and bonded to fin collars for maximum thermal conductivity. Use of soldering or tinning

during the fin-to-tube bonding process is not acceptable due to the inherent thermal stress and possible loss of bonding at that joint.

D. Construct coil casings of galvanized steel [stainless steel]. End supports and tube sheets shall have belled tube holes to minimize wear of the tube wall during thermal expansion and contraction of the tube.

E. All coils shall be completely cleaned prior to installation into the air handling unit. Complete fin bundle in direction of airflow shall be degreased and steam cleaned to remove any lubricants used in the manufacturing of the fins, or dirt that may have accumulated, in order to minimize the chance for water carryover.

F. On units with two coils in the airstream, space shall be provided by the unit manufacturer to facilitate cleaning and inspection of the fin surfaces. Access door(s) shall be located in the unit casing between the two coils. Construct door(s) in accordance with Section 2.04.

G. Hydronic Coils:

1. Supply and return header connections shall be such that direction of coil water-flow is counter to direction of unit air-flow.
2. Coils shall be proof-tested to 300 psig and leak-tested to 200 psig air pressure under water.
3. Headers shall be constructed of round copper pipe.
4. Tubes shall be 1/2-inch .016 copper, with aluminum fins.
5. Contractor shall install extended drain and vent pipes from coil headers in the field.

H. Refrigerant Cooling Coils:

1. Refrigerant suction and liquid connections shall penetrate through unit casing to facilitate refrigerant piping in the field.
2. Coils shall be proof tested to 450 psig and leak tested to 300 psig air pressure under water. After testing, insides of tubes shall be air dried, charged with dry nitrogen or dry air, and sealed to prevent contamination.
3. Refrigerant suction and liquid headers shall be constructed of copper tubing. Suction and liquid connections shall penetrate unit casings to allow for sweat connections to refrigerant lines.
4. Tubes shall be 1/2 inch O.D., minimum .016 inch thick copper. Fins shall be aluminum.
5. Coils shall have equalizing type vertical distributors sized in conjunction with capacities of coils.

2.9 FILTERS:

A. Provide factory-fabricated filter section of the same construction and finish as unit casings. Filter section shall have side access filter guides and access door(s) extending the full height of the casing to facilitate filter removal. Construct doors in accordance with Section 2.04. Provide fixed filter blockoffs as required to prevent air bypass around filters. Blockoffs shall not need to be removed during filter

replacement. Filters to be of size, and quantity needed to maximize filter face area of each particular unit size.

B. Filter type, MERV rating, and arrangement shall be provided as defined in project plans and schedule.

C. One set of start-up filters shall be supplied.

2.10 DAMPERS:

A. All dampers shall be internally mounted. Dampers shall be premium ultra low leak and located as indicated on the schedule and plans. Parallel blade arrangement shall be provided as indicated on the schedule and drawings. Dampers shall be double-skin airfoil design for minimal air leakage and pressure drop. Leakage rate shall not exceed 3 CFM/square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage and shall be AMCA licensed for Class 1A. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D.

2.11 VARIABLE FREQUENCY DRIVE:

A. Service Conditions:

1. VFDs shall provide full output in an ambient temperature from -10 to 50°C (14 to 104°F).
2. VFDs shall provide full output in a relative humidity from 0 to 95%, non-condensing.
3. VFDs shall provide full output up to 3,300 feet elevation without derating.
4. VFDs shall provide full output with an AC line voltage variation from -10 to +10% of nominal voltage.
5. No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

B. Warranty:

1. The VFD shall be warranted by the manufacturer for a period of 42 months from date of shipment, or 36 months from start-up, which ever occurs first. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory-authorized on-site service.

2.12 FACTORY-INSTALLED MOTOR WIRE TERMINATION, VFD, AND STARTER ENCLOSURES:

A. VFDs or starter shall be factory mounted on the drive side of the fan section.

B. Any welds shall be properly finished with no rough edges. Enclosures shall house, Drive-OFF switches, manual speed controls, and control transformers.

2.13 FACTORY WIRING OF VFD'S AND STARTERS:

A. VFDs shall be wired per NEC, UL, and NFPA 90A requirements. Units with factory-mounted controls shall also include power wiring from the VFD or starter control transformer to the control system transformers. After mounting and wiring of VFDs, on the AHUs, trained factory personnel shall ensure proper operation of each VFD, through a thorough factory test. Testing shall include a Hypot test of unit wiring to ensure that no weaknesses exist in wiring or motor. Each VFD shall be energized and the fan run to ensure the VFD will operate throughout the usable range of the drive and that the fan rotation is correct.

B. On units provided with factory mounted and wired supply fan starter or VFD and DDC controls, the manufacturer shall provide a single point of power. Line-to-24v transformers shall be provided with sufficient vA to power the factory installed control points.

2.14 FACTORY-ENGINEERED AUTOMATIC TEMPERATURE CONTROLS:

A. Unit shall be provided with a factory wired, installed and tested unit controller, capable of standalone unit control, or tied into a building automation system through BACnet communication. All control points in unit shall be tested at the unit manufacturer's facility prior to shipment.

B. Damper actuators shall be selected, provided, and mounted by the AHU manufacturer on each damper. Actuators shall be of sufficient size and quantity to ensure complete damper operation. Actuators shall be direct coupled to minimize linkage.

C. Differential pressure switch shall be provided by the AHU manufacturer. Pressure switches shall be factory installed across the filter bank to monitor clean/dirty filter status.

D. Low limits shall be factory engineered to maximize coil coverage. Capillary radius clips shall be used at low limit bends to ensure no crimping or wear of low limits. Low limits shall be wired to shut down the fan to protect the unit.

E. Fan status switches shall be provided and mounted by the AHU manufacturer.

F. On variable volume units, a discharge temperature sensor shall be provided and mounted on the fans by the AHU manufacturer.

G. Outside air temperature sensors shall be provided at the jobsite.

H. Averaging temperature sensors shall be provided by the AHU manufacturer. Sensors shall be factory engineered to accurately measure mixed air temperatures. Capillary radius clips shall be used at capillary bends to ensure no crimping or wear of the tube.

I. For variable-air-volume units, duct static pressure switches shall be provided by the AHU manufacturer in the unit. Switches shall be piped in the field.

PART 3 - EXECUTION

3.1 INSTALLATION OF AIR HANDLING UNITS:

A. General: Install air handling units where indicated, in accordance with equipment manufacturer's published installation instructions and with recognized industry practices, to ensure that units comply with requirements and serve intended purposes.

B. Coordination: Coordinate with other work, including ductwork, roof decking and piping, as necessary to interface installation of air handling units with other work.

C. Access: Provide access space around air handling units for service as indicated, but in no case less than that recommended by manufacturer.

D. Support: Install indoor air handling units on a minimum 4” high concrete housekeeping pad. Coordinate installation with General Contractor for final size of pad.

E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

F. Piping Connections: Refer to Division-23 HVAC sections. Provide piping, valves, accessories, gauges, supports and flexible connectors as indicated.

G. Duct Connections: Refer to Division-23 Air Distribution sections. Provide ductwork, accessories and flexible connections as indicated.

H. Grounding: Provide positive equipment ground for air handling unit components.

3.2 FIELD QUALITY CONTROL:

A. Testing: Upon completion of installation of air handling units, start-up and operate equipment to demonstrate capability and compliance with requirements. Field correct malfunctioning units, then retest to demonstrate compliance.

3.3 EXTRA STOCK:

A. Provide one complete extra set of filters for each air handling unit. Install new filters at completion of air handling system work and prior to testing, adjusting and balancing work. Obtain receipt from Owner that new filters have been installed.

B. Provide one spare set of belts for each belt-driven air handling unit, obtain receipt from Owner that belts have been received.

END OF SECTION 237300

SECTION 238127 DX CONDENSING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Commercial air-cooled condensing units.

1.2 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights (shipping, installed, and operating), dimensions, required clearances, and methods of assembly of components, furnished specialties and accessories; and installation and start-up instructions.

B. Wiring Diagrams: Submit ladder-type wiring diagrams for power and control wiring required for final installation of condensing units and controls. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

C. Operation and Maintenance Manuals: Submit maintenance data and parts list for each condensing unit, control, and accessory; including "trouble shooting" maintenance guide; plus servicing, and preventive maintenance procedures and schedule. Include this data and product data in maintenance manual.

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. Capacity ratings for condensing units shall be in accordance with ARI Standard 360 "Standard for Commercial and Industrial Unitary Air-Conditioning Equipment".
2. Condensing units shall meet or exceed the minimum COP/Efficiency levels as prescribed in ASHRAE 90A "Energy Conservation in New Building Design", latest edition.
3. Condensing units shall be listed by UL and have UL label affixed.

1.4 DELIVERY, STORAGE, AND HANDLING:

A. Handle condensing units and components carefully to prevent damage. Follow manufacturer's written instructions for rigging. Replace damaged condensing units or components.

B. Store condensing units and components in clean dry place off the ground. Protect from weather, water, and physical damage.

1.5 SPECIAL PROJECT WARRANTY:

A. Warranty on Motor/Compressor: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, motors/compressors with inadequate or defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.

1. Warranty Period: 5 years from date of startup.

PART 2 - PRODUCTS

2.1 AIR-COOLED CONDENSING UNITS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering air-cooled condensing units which may be incorporated in the work include the following.

1. Trane (The) Co.; Div. American Standard Inc.
2. Daiken McQuay
3. Carrier

B. General: Factory-assembled and tested air-cooled condensing units, consisting of compressor, condenser coil, fan, motor, refrigerant reservoir, and operating controls. Capacity and electrical characteristics are scheduled on the Drawings.

C. Casing: Galvanized steel finished with baked enamel, complete with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Unit shall be complete with brass service valves, fittings, and gage ports on exterior of casing.

D. Compressor: Hermetically sealed, scroll type, with built-in overloads and vibration isolation. Compressor motor, shall have thermal and current sensitive overload devices, internal high-pressure protection, high and low pressure cutout switches, start capacitor and relay, 2-pole contactor, crankcase heater, and temperature actuated switch and timer to prevent compressor rapid cycle.

E. Condenser: Coil shall have copper tubes and aluminum fins, or aluminum tubes and aluminum fins; complete with liquid accumulator and liquid subcooler. Aluminum propeller fans shall be direct driven, with permanently lubricated fan motor having thermal overload protection.

F. Refrigerant: R454B.

G. Accessories: Furnish the following:

1. Low-voltage thermostat and subbase to control condensing unit and evaporator.
2. Service Valves
3. Refrigerant Filter – Drier
4. Moisture-Liquid Indicators
5. Field installed solenoid valve on liquid line near the evaporator.
6. Other accessories as listed in the schedule.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

A. General: Install condensing units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommend clearance.

B. Support:

1. Install ground-mounted units on 4" thick reinforced concrete pad, 4" large on each side than condensing unit.

C. Connect refrigerant tubing to unit's fittings. Run tubing so as not to interfere with access to unit.

1. Install furnished accessories.

D. Install furnished field-mounted accessories.

3.3 FIELD QUALITY CONTROL:

A. Testing:

1. Pull a vacuum on the system in accordance with manufacturers installation instructions.
2. Charge systems with refrigerant and oil, and test for leaks. Repair leaks and replace lost refrigerant and oil.

3.4 DEMONSTRATION:

A. Start-up condensing units, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

END OF SECTION 238127

SECTION 260519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Copper building wire rated 600 V or less.

2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Section 260523 “Control-Voltage Electrical Power Cables” for control systems communications cables and Classes 1, 2, and 3 control cables.

1.3 DEFINITIONS

A. RoHS: Restriction of Hazardous Substances.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

2. RoHS compliant.

3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

D. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast connectors with set screws, designed to connect conductors specified in this section.

C. Lugs: One piece, seamless, designed to terminate conductors specified in this section.

1. Material: Copper

2. Termination: Compression

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders and Branch Circuits: Copper. Solid for No. 10 AWG and smaller. Stranded for No. 8 AWG and larger.

B. VFD Output Circuits: Extra-flexible stranded for all sizes.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.

B. Feeders and Branch Circuits: Type THHN/THWN-2, single conductors in raceway.

C. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours to extent possible.

F. Support cables according to Section 260529 “Hangers and Supports for Electrical Systems.”

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each of the following visual and electrical tests:

    a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.

    b. Test bolted connections for high resistance using one of the following:

        1) A low-resistance ohmmeter

        2) Calibrated torque wrench

    c. Inspect compression-applied connectors for correct cable match and indentation.

    d. Inspect for correct identification.

    e. Inspect cable jacket and condition.

    f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.

    g. Continuity test on each conductor and cable.

    h. Uniform resistance of parallel conductors.

B. Cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports to record the following:

1. Procedures used

2. Results that comply with requirements

3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:

1) Ground rods.

2) Ground rings.

3) Grounding arrangements and connections for separately derived systems.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable THHN or THWN-2 insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B3.

2. Stranded Conductors: ASTM B8.

3. Tinned Conductors: ASTM B33.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Conduit Hubs: Mechanical type, terminal with threaded hub.

G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

H. Lay-in Lug Connector: Mechanical type, copper, rated for direct burial, terminal with set screw.

I. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

J. Straps: Solid copper, copper lugs. Rated for 600 A.

K. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal two-piece clamp.

L. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

M. Water Pipe Clamps:

1. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Main Bonding Jumper: #3/0 AWG.

C. Grounding Electrode Conductor: #3/0 AWG continuous bare copper wire. Above ground portions of grounding electrode conductor shall be installed in rigid galvanized steel conduit. Underground portions of grounding electrode conductor shall be direct buried a minimum of 12” below finished grade.

D. Grounding Electrode Bonding Jumpers: #3/0 AWG continuous bare copper wire. Connections between grounding electrode bonding jumpers and grounding electrodes shall be exothermic weld except for in test wells. Install grounding electrode bonding jumpers a minimum of 12” below finished grade.

E. Equipment Grounding Conductors: Green-colored insulation sized per drawings.

F. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Connections to Ground Rods:

   a. At Test Wells: Bolted connectors.

   b. All Others: Welded connectors.

3. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

C. Manufacturer Supplied Equipment: Where manufacturers of supplied equipment recommend bonding said equipment to the grounding electrode system, contractor shall install bare copper wire, sized per manufacturer's instructions, and bond to manufacturer supplied equipment and to grounding electrode system. Where the manufacturer does not specify the size of grounding wire, the contractor shall use #8 AWG.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

   2. Use exothermic welds for all below-grade connections.

3. For grounding electrode system, install number of rods as indicated on drawings, spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3. The requirements of this section also apply to all buildings and facilities supplied by the facility main electrical service.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

1. Grounding Electrode Conductor: Install a grounding electrode conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building, area or item indicated.

a. Bury grounding electrode conductor not less than 24 inches from building's foundation.

G. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

b. Perform tests by fall-of-potential method according to IEEE 81.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.

2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.

3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.

4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).

5. Substations and Pad-Mounted Equipment: 5 ohms.

6. Manhole Grounds: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

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SECTION 260529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components, including mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.

B. Related Requirements:

1. Section 260548.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
    a. Slotted support systems, hardware, and accessories.
    b. Clamps.
    c. Hangers.
    d. Sockets.

e. Eye nuts.

f. Fasteners.

g. Anchors.

h. Saddles.

i. Brackets.

2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

1. Hangers. Include product data for components.

2. Slotted support systems.

3. Equipment supports.

4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, “Structural Welding Code – Steel” and AWS D1.2/D1.2M “Structural Welding Code – Aluminum.”

B. Comply with NFPA 70

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the supported equipment and systems will be fully operational after the seismic event."

2. Component Importance Factor:

a. 1.5 for life-safety systems including fire protection systems, mechanical smoke removal systems, and emergency/stand-by electrical systems.

b. 1.0 otherwise.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.

1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.

2. Material for Channel, Fittings, and Accessories: Stainless steel, Type 304.

3. Channel Width: Selected for applicable load criteria.

4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

B. Conduit and Cable Support Devices: Stainless-steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.

3. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.

4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.

5. Toggle Bolts: Stainless-steel springhead type.

6. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Miscellaneous Metals" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1

2. NECA 101

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in the future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT IMC and RMC may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to facility structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.

5. To Steel:

    a. Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.

    b. Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.

6. To Light Steel: Sheet metal screws.

7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Miscellaneous Metals" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 099000 "Painting and Coating" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION

SECTION 260533 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Underground duct accessories.
8. Duct Sealing for underground ducts and duct banks.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit

B. EMT: Electrical metallic tubing

C. FMC: Flexible metallic conduit

D. GRC: Galvanized rigid steel conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metallic conduit.

G. RNC: Rigid nonmetallic conduit

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

2. Factory-Fabricated Manholes, Handholes, and Boxes:

a. Include plans, elevations, sections, and details, including attachments to other work.

b. Include duct entry provisions, including locations and duct sizes, and methods and materials for waterproofing duct entry locations.

c. Include reinforcement details.

d. Include frame and cover design and manhole chimneys.

e. Include ladder or step details.

f. Include grounding details.

g. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, sumps, and other accessories.

h. Include joint details.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from the manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND DITTINGS

A. Metal Conduit:

1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. ARC: Comply with ANSI C80.5, and UL 6A.

3. EMT: Comply with ANSI C80.3 and UL 797.

4. FMC: Comply with UL 1; zinc-coated steel or aluminum.

5. GRC: Comply with ANSI C80.1 and UL 6.

6. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

7. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

    a. Comply with NEMA RN 1.

    b. Coating Thickness: 0.040 inch, minimum.

B. Metal Fittings:

1. Comply with NEMA FB 1 and UL 514B.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. Fittings, General: Listed and labeled for type of conduit, location, and use.

4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.

5. Expansion Fittings: Fiberglass, PVC, or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

6. Rigid and intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Fiberglass Conduit: Reinforced Thermosetting Resin Conduit (RTRC) shall conform to the following specifications:

a. Manufacturers: Subject to compliance with specifications, provide products from one of the following manufacturers:

1) Champion Fiberglass

2) United Fiberglass of America

3) Approved Equal: Approved equals must be an ISO9001 company and must be approved 28 calendar days prior to bid date.

b. Comply with NEMA TC14, UL 2515 for aboveground raceways, and UL 2420 for belowground raceways.

3. PVC Conduit:

a. Schedule 40, complying with NEMA TC 2 and UL 651.

4. Liquid-Tight Flexible Non-Metallic Conduit:

a. Comply with UL 1660

B. Nonmetallic Fittings:

1. General: Listed and labeled for type of conduit, location, and use.

2. For RNC: Comply with NEMA TC 3. Match to conduit or tubing type and material.

3. For LFNC: Comply with UL 514B and NEMA FB 2.20.

4. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Listing and Labeling: Metallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, Type 4X, stainless steel and Type 12 to match requirements for boxes and enclosures at the location installed, unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

C. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

D. Solvents and Adhesives: As recommended by conduit manufacturer.

2.5 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

D. Tele-Power Poles:

1. Material: Galvanized steel with ivory baked-enamel finish.

2. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Metal Floor Boxes:

1. Material: sheet metal.

2. Type: Semi-adjustable.

3. Shape: Rectangular.

4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Nonmetallic Floor Boxes: Nonadjustable, rectangular.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

H. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.

1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or cast iron with gasketed cover.

K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

L. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep.

M. Multigang boxes shall be of single piece construction.

N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

2. Nonmetallic Enclosures: Plastic.

3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

O. Cabinets:

1. NEMA 250, Type 3R box with removable interior panel and removable front, finished inside and out with manufacturer’s standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.

3. Key latch to match panelboards.

4. Metal barriers to separate wiring of different systems and voltage.

5. Accessory feet where required for freestanding equipment.

6. Metallic cabinets: Galvanized steel, listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

7. Nonmetallic cabinets: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 UNDERGROUND DUCT ACCESSORIES

A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.

2.8 DUCT SEALING

A. Duct Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Compound must be capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals. Duct sealing compound must be removable without damaging ducts or cables.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. General: Contractor shall attend a certified training for fiberglass conduit installation or produce a certificate indicating successful completion of previous training if fiberglass conduit it utilized.

B. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Aboveground Conduit: GRC.

2. Underground Conduit: Fiberglass (RTRC) or PVC schedule 40, concrete encased under pavement, direct buried for runs not under pavement.

3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

4. Boxes and Enclosures, Aboveground: NEMA 250, Type 4x SS unless otherwise stated on drawings.

C. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed: GRC unless otherwise indicated on drawings.

2. Exposed and Subject to Corrosion: PVC-Coated GRC. Raceway locations include the following:

a. Chemical storage, mixing, metering and handling areas.

b. Areas specifically identified on the drawings.

3. Concealed in Ceilings and Interior Walls and Partitions: Fiberglass (RTRC) or PVC schedule 40.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp and wet locations and chemical buildings.

5. Boxes and Enclosures: NEMA 250, Type 12 stainless steel unless otherwise indicated on drawings, except use 4X SS in damp, wet, or corrosive locations.

D. Minimum Raceway Size:

1. Aboveground locations: 3/4-inch trade size.

2. Underground locations: 1-inch trade size.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass-through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

3.2 INSTALLATION

A. Comply with requirements in Section 260529 “Hangers and Supports for Electrical Systems” for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

D. Do not fasten conduits onto the bottom side of a metal deck roof.

E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Complete raceway installation before starting conductor installation.

G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

I. Field Bends:

1. Field bends should be performed when manufactured bends are not available.

2. Field bending shall be according to NFPA 70 minimum radii requirements and per manufacturer instructions.

3. Use only equipment specifically designed for material and size involved.

J. General Conduit and Boxes Installation:

1. Interior finished spaces including but not necessarily limited to offices, control rooms, laboratories, toilets, conference rooms, office storage rooms and other similar locations:

    a. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated.

2. Interior process, mechanical and electrical spaces:

    a. Exposed conduit and boxes, unless otherwise indicated.

3. Exterior locations:

a. Conceal all raceway and boxes serving lighting, receptacles, HVAC equipment and similar devices and equipment at the exterior walls of buildings.

b. All other conduits and boxes exposed, unless otherwise indicated.

4. Install conduits parallel or perpendicular to building and construction lines.

K. Support conduit within 12 inches of enclosures to which attached.

L. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.

2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.

4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

N. Coat field-cut threads with a corrosion-preventing conductive compound prior to assembly.

O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

P. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

R. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

S. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

T. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.

2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

U. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

V. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where an underground service raceway enters a building or structure.

3. Conduit extending from interior to exterior of building.

4. Conduit extending into pressurized duct and equipment.

5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.

6. Where otherwise required by NFPA 70.

W. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

X. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.

2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.

b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.

c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.

4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

Y. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches of flexible conduit for recessed and semi recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations.

Z. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements.

AA. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

BB. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

CC. Locate boxes so that cover or plate will not span different building finishes.

DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

EE. Floor boxes: Set level and flush with finished floor surface. For nonmetallic boxes, trim after installation to fit flush with floor surface.

FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 EXTERIOR DUCTBANK INSTALLATION

A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in field. Notify Engineer if there is conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Engineer.

C. Clear and grub vegetation to be removed, and protect vegetation to remain in accordance with Section 311000 "Site Clearing." Remove and stockpile topsoil for reapplication in accordance with Section 311000 "Site Clearing".

D. Restore area after construction vehicle traffic in immediate area is complete. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

E. Cut and Patch existing pavement in path of underground duct, duct bank, and underground structures. Patched pavement shall be of substantially similar material and workmanship as original pavement.

F. Expansion and Deflection Fittings: Install expansion and deflection fitting in each duct in area of disturbed earth adjacent to manhole or handhole.

G. Install expansion fitting near center of straight line duct with calculated expansion of more than 3/4 inch.

H. Curves and Bends:

1. Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with minimum radius of 48 inch, both horizontally and vertically, at other locations unless otherwise indicated.

2. Field bending must be in accordance with NFPA 70 minimum radii requirements, except bends over 45 degrees must be made with minimum radius of 48 inch. Use only equipment specifically designed for material and size involved. Use PVC heating bender for bending PVC conduit.

3. Duct must have maximum of 180 degrees of bends between pull points.

I. Joints: Use solvent-cemented joints in nonmetallic duct and fittings and make watertight in accordance with manufacturer's published instructions. Stagger couplings so those of adjacent duct do not lie in same plane. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with minimum 3 inch of concrete for minimum of 12 inch on each side of coupling.

1. Install insulated grounding bushings on steel raceway terminations that are less than 12 inch below grade or floor level and do not terminate in hubs.

J. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inch o.c. for 5 inch duct, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 ft from end bell, without reducing duct slope and without forming trap in line.

2. Grout end bells into structure walls from both sides to provide watertight entrances.

K. Building Wall Penetrations: Make transition from underground duct to steel raceway at least 10 ft outside building wall, without reducing duct line slope away from building and without forming trap in line. Use fittings manufactured for transition to steel raceway type installed. Install steel raceway penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling".

L. Install manufactured steel raceway elbows for stub-ups at poles unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.

1. Couple steel elbows to ducts with adapters designed for this purpose, and encase coupling with minimum 3 inch of concrete for minimum of 12 inch on each side of coupling.

M. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15 psig hydrostatic pressure.

N. Direct Buried Ducts and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inches in nominal diameter.

2. Width: Excavate trench 3 inches wider than duct on each side.

3. Depth: Install top of duct at least 24 inches below finished grade unless otherwise indicated.

a. Set elevation of top of duct bank below frost line.

4. Place minimum 3 inches of sand as bed for duct. Place sand to minimum of 3 inches above top level of duct.

5. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

6. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 ft of duct. Place spacers within 24 inch of duct ends. Stagger spacers approximately 6 inch between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

7. Install manufactured duct elbows at changes of direction in duct direction unless otherwise indicated.

8. Install manufactured steel elbows for stub-ups, and at building entrances.

   a. Couple RNC or RTRC duct to steel raceway with adapters designed for this purpose.

   b. Stub-ups to Outdoor Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inch from edge of base. Install insulated grounding bushings on terminations at equipment.

      1) Stub-ups must be minimum 4 inch above finished base and minimum 3 inch from conduit side to edge of base.

   c. Stub-ups to Indoor Equipment: Extend concrete-encased steel raceway horizontally on exterior of wall minimum of 60 inch from edge of wall. Install insulated grounding bushings on terminations at equipment.

   d. Stub-ups through interior floors must be minimum 4 inches above finished floor and no less than 3 inch from conduit side to edge of equipment pad or floor slab.

9. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inch over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312000 "Earth Moving" for installation of backfill materials.

O. Underground-line Warning Tape: Bury conducting underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inch above underground duct and duct banks and approximately 12 inch below grade. Align tape parallel to and within 3 inch of centerline of duct bank. Provide additional warning tape for each 12 inch increment of duct-bank width over nominal 18 inch. Space additional tapes 12 inch apart, horizontally across width of ducts.

P. Ground ducts and duct banks in accordance with Section 260526 "Grounding and Bonding for Electrical Systems".

3.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 260548.16 SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Restraint channel bracings.
2. Restraint cables.
3. Seismic-restraint accessories.
4. Mechanical anchor bolts.
5. Adhesive anchor bolts.

B. Related Requirements:

1. Section 260529 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval from OSHPD in addition to preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 RESTRAINT CHANNEL BRACINGS

A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.2 RESTRAINT CABLES

A. Restraint Cables: ASTM A492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.3 SEISMIC-RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.

D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.4 MECHANICAL ANCHOR BOLTS

A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488/E488M.

2.5 ADHESIVE ANCHOR BOLTS

A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488/E488M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

B. Equipment and Hanger Restraints:

1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

F. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.

5. Set anchors to manufacturer's recommended torque using a torque wrench.

6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Engineer, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.

3. Obtain Engineer's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.

5. Test to 90 percent of rated proof load of device.

B. Seismic controls will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

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SECTION 260553 IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Labels.
2. Bands and tubes.
3. Tapes and stencils.
4. Tags.
5. Signs.
6. Cable ties.
7. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ANSI/ASME A13.1 for electrical conduits.

B. Comply with NFPA 70 and IEEE C2.

C. Comply with 29 CFR 1910.144 for fire-protection systems and ceiling-mounted hangers, supports, cable trays, and raceways.

D. Comply with 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs.

E. Comply with ANSI Z535.4 for safety signs and labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.

2. Legend: Indicate voltage.

B. Raceways and Cables Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.

2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

C. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.

2. Colors for 208/120-V Circuits:

a. Phase A: Black.

b. Phase B: Red.

c. Phase C: Blue.

3. Colors for 240-V Circuits:

a. Phase A: Black.

b. Phase B: Red.

4. Colors for 480/277-V Circuits:

a. Phase A: Brown.

b. Phase B: Orange.

c. Phase C: Yellow.

5. Color for Neutral: White.

6. Color for Equipment Grounds: Green.

7. Colors for Isolated Grounds: Green with two or more yellow stripes.

D. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

E. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

F. Equipment Identification Labels:

1. Black letters on a white field.

2. Equipment to be labeled shall include:

a. Motor Control Centers.

b. Panelboards.

c. Switches.

d. Transformers.

e. Disconnects.

f. Motors.

3. Equipment labels shall include general information such as Voltage, Fed From (Feeder source), and Date of Installation. Motor labels shall also include horsepower, and transformer labels shall include primary and secondary voltages and KVA rating.

4. See detail on drawings showing example label layout as well as additional requirements.

2.3 CONDUCTOR LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

2.4 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters and that stay in place by gripping action.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

2.5 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

C. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

D. Underground-Line Warning Tape:

1. Tape:

    a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.

    b. Printing on tape shall be permanent and shall not be damaged by burial operations.

    c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

2. Color and Printing:

    a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.

    b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".

    c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

2.6 TAGS

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.023 inch thick, color-coded for phase and voltage level, with factory screened permanent designations; punched for use with self-locking cable tie fastener.

C. Write-on Tags:

1. Polyester Tags: 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment.

2. Marker for Tags:

a. Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.7 SIGNS

A. Baked-Enamel Signs:

1. Pre-printed aluminum signs punched or drilled for fasteners, with colors, legend, and size required for application.

2. 1/4-inch grommets in corners for mounting.

3. Nominal Size: 7 by 10 inches.

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.

2. 1/4-inch grommets in corners for mounting.

3. Nominal Size: 10 by 14 inches.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.

2. Thickness:

a. For signs up to 20 sq. in., minimum 1/16 inch thick.

b. For signs larger than 20 sq. in., 1/8 inch thick.

c. Engraved legend with white letters on a dark gray background.

d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.

2.8 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.

2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.

3. Temperature Range: Minus 40 to plus 185 deg F.

4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.

2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.

3. Temperature Range: Minus 40 to plus 185 deg F.

4. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

L. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.

2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

M. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

N. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

O. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.

2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.

P. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

Q. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

R. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

S. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

T. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

U. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

V. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at approximately 12 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 18 inches overall.

2. Install underground-line warning tape for direct-buried cables and cables in raceways.

W. Metal Tags:

1. Place in a location with high visibility and accessibility.

2. Secure using general-purpose cable ties.

X. Nonmetallic Preprinted Tags:

1. Place in a location with high visibility and accessibility.

2. Secure using general-purpose cable ties.

Y. Write-on Tags:

1. Place in a location with high visibility and accessibility.

2. Secure using general-purpose cable ties.

Z. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.

AA. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.

BB. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.

CC. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.

2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."

2. "POWER."

3. "UPS."

E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify the phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.

G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with the conductor designation.

H. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

I. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

J. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

K. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.

1. Apply to exterior of door, cover, or other access.

2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

    a. Power-transfer switches.

    b. Controls with external control power connections.

M. Operating Instruction Signs: Self-adhesive labels.

N. Emergency Operating Instruction Signs: Self-adhesive labels with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

O. Equipment Identification Labels:

1. Indoor Equipment: Laminated acrylic or melamine plastic sign.

2. Outdoor Equipment: 302 Stainless steel..

3. Equipment to Be Labeled:

    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved, laminated acrylic or melamine label.

    b. Enclosures and electrical cabinets.

    c. Access doors and panels for concealed electrical items.

    d. Switchgear.

    e. Switchboards.

    f. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.

    g. Substations.

    h. Emergency system boxes and enclosures.

    i. Motor-control centers.

    j. Enclosed switches.

    k. Enclosed circuit breakers.

    l. Enclosed controllers.

    m. Variable-speed controllers.

    n. Push-button stations.

o. Power-transfer equipment.

p. Contactors.

q. Remote-controlled switches, dimmer modules, and control devices.

r. Battery-inverter units.

s. Battery racks.

t. Power-generating units.

u. Monitoring and control equipment.

v. UPS equipment.

END OF SECTION

SECTION 262213 LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.

2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.

3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for transformers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

4. Certification: Indicate that equipment meets equipment seismic requirements.

B. Source quality-control reports.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspection: On receipt, inspect for and note any shipping damage to packaging and transformer.

1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.

B. Storage: Store in a warm, dry, and temperature-stable location in original shipping packaging.

C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB (Electrification Products Division).

2. Eaton.

3. Siemens Industry, Inc., Energy Management Division

4. Schneider Electric USA (Square D).

B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Transformers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the transformer will remain in place without separation of any parts when subjected to the seismic forces specified and the transformer will be fully operational after the seismic event."

2.3 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Comply with NFPA 70.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Transformers Rated 15 kVA and Larger:

1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.

2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.

D. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.4 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70, and list and label as complying with UL 1561.

B. Provide transformers that are constructed to withstand seismic forces specified in Section 260548.16 "Seismic Controls for Electrical Systems."

C. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

1. One leg per phase.

2. Grounded to enclosure.

D. Coils: Continuous windings without splices except for taps.

1. Coil Material: Aluminum.

2. Internal Coil Connections: Brazed or pressure type.

3. Terminal Connections: Bolted or welded.

E. Enclosure: Ventilated.

1. Core and coil shall be encapsulated within resin compound using a vacuum-pressure impregnation process to seal out moisture and air.

2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.

3. Wiring Compartment: Sized for conduit entry and wiring installation.

4. Environmental Protection, unless otherwise noted:

a. Indoor: UL50E, Type 2

b. Outdoor: UL 50E, Type 3R

5. Finish: Comply with NEMA 250.

a. Finish Color: Gray weather-resistant enamel.

F. Taps:

1. For Transformers 25 kVA and larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

G. Insulation Class:

1. For Transformers 30 kVA and larger: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

H. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.

I. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.

1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.

2. Include special terminal for grounding the shield.

J. Neutral: Rated 200 percent of full load current for K-factor-rated transformers.

K. Wall Brackets: Manufacturer's standard brackets or, when required by seismic loading, wall brackets fabricated from design drawings signed and sealed by a licensed structural engineer.

2.5 IDENTIFICATION

A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.6 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.

1. Resistance measurements of all windings at rated voltage connections and at all tap connections.

2. Ratio tests at rated voltage connections and at all tap connections.

3. Phase relation and polarity tests at rated voltage connections.

4. No load losses, and excitation current and rated voltage at rated voltage connections.

5. Impedance and load losses at rated current and rated frequency at rated voltage connections.

6. Applied and induced tensile tests.

7. Regulation and efficiency at rated load and voltage.

8. Insulation-Resistance Tests:

    a. High-voltage to ground.

    b. Low-voltage to ground.

    c. High-voltage to low-voltage.

9. Temperature tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

B. Construct concrete bases according to Section 033000 "Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

C. Secure transformer to concrete base according to manufacturer's written instructions.

D. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

E. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

A. Contractor to test and inspect components, assemblies, and equipment installations, including connections as follows.

B. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:

1. Visual and Mechanical Inspection.

a. Inspect physical and mechanical condition.

b. Inspect anchorage, alignment, and grounding.

c. Verify that resilient mounts are free and that any shipping brackets have been removed.

d. Verify the unit is clean.

e. Perform specific inspections and mechanical tests recommended by manufacturer.

f. Verify that as-left tap connections are as specified or as required to ensure proper voltage at load.

g. Verify the presence of surge arresters and that their ratings are as specified.

2. Electrical Tests:

a. Measure resistance at each winding, tap, and bolted connection.

b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.

c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.

d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at

secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 262416 PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards

2. Lighting and appliance branch-circuit panelboards

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. MCCB: Molded-case circuit breaker.

E. SPD: Surge protective device.

F. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.

2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.

2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.

3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.

4. Detail bus configuration, current, and voltage ratings.

5. Short-circuit current rating of panelboards and overcurrent protective devices.

6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

7. Include wiring diagrams for power, signal, and control wiring.

8. Key interlock scheme drawing and sequence of operations.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 certified

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.

b. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Engineer and Owner no fewer than two days in advance of proposed interruption of electric service.

2. Do not proceed with interruption of electric service without Owner's written permission.

3. Comply with NFPA 70E.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS AND LOAD CENTER COMMON REQUIREMENTS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

F. Enclosures: Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location. Provide equipment rated as indicated below, unless otherwise noted.

    a. Indoor, dry and clean locations: NEMA 250, Type 1.

    b. Outdoor locations: NEMA 250, Type 3R.

    c. Corrosive locations: NEMA 250, Type 4X, stainless steel.

2. Height: 84 inches maximum.

3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

4. Finishes:

    a. Panels and Trim: Galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.

    b. Back Boxes: Same finish as panels and trim.

G. Incoming Mains:

1. Location: Convertible between top and bottom.

2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

H. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

a. Plating shall run entire length of bus.

b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.

3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

I. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Terminations shall allow use of 75 deg C rated conductors without derating.

3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.

4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.

5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.

J. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices.

K. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices as indicated in Drawings.

L. Panelboard Short-Circuit Current Rating: Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices shall have short-circuit ratings as indicated in Drawings.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB (Electrification Products Division).

2. Eaton.

3. Schneider Electric USA (Square D).

4. Siemens Industry, Inc., Energy Management Division.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Electrical Ratings:

1. Voltage Configuration: See panel schedules on Drawings.

2. Bus Ratings: See panel schedules on Drawings.

D. Mains: Circuit breaker or main lug only as indicated in panel schedules on Drawings.

E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB (Electrification Products Division).

2. Eaton.

3. Schneider Electric USA (Square D).

4. Siemens Industry, Inc., Energy Management Division.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

    a. Inverse time-current element for low-level overloads.

    b. Instantaneous magnetic trip element for short circuits.

    c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).

3. Electronic Trip Circuit Breakers:

    a. RMS sensing.

    b. Field-replaceable rating plug or electronic trip.

    c. Digital display of settings, trip targets, and indicated metering displays.

    d. Multi-button keypad to access programmable functions and monitored data.

    e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.

    f. Integral test jack for connection to portable test set or laptop computer.

    g. Field-Adjustable Settings:

        1) Instantaneous trip.

        2) Long- and short-time pickup levels.

        3) Long and short time delay adjustments.

4. MCCB Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.

    b. Breaker handle indicates tripped status.

    c. UL listed for reverse connection without restrictive line or load ratings.

    d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

    e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.

f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

g. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.

2.5 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NECA 407.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NECA 407.

D. Equipment Mounting:

1. Attach panelboard to the vertical finished or structural surface behind the panelboard.

2. Comply with requirements for seismic control devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount panelboards so that operating handle of top-most switch or circuit breaker, in on position, is no higher than 75 inches AFF.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

I. Install overcurrent protective devices not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

J. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

K. Install filler plates in unused spaces.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Contractor shall inspect components, assemblies, and equipment installations, including connections as follows.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Perform optional tests. Certify compliance with test parameters.

2. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

3. Test continuity of each circuit.

4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

5. Panelboards will be considered defective if they do not pass tests and inspections.

6. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 262726 WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Standard-grade receptacles, 125 V, 20 A.

B. GFCI receptacles, 125 V, 20 A.

C. Toggle switches, 120/277 V, 20 A.

D. Occupancy sensors.

E. Wall plates.

1.3 DEFINITIONS

A. AFCI: Arc-fault circuit interrupter.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.

C. RoHS compliant.

D. Comply with NEMA WD 1.

E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.

2. Devices shall comply with requirements in this Section.

F. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.

2. Cord and Plug Sets: Match equipment requirements.

G. Device Color:

1. Wiring Devices Connected to Normal Power System: Ivory unless otherwise indicated or required by NFPA 70 or device listing.

H. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding.

2. Configuration: NEMA WD 6, Configuration 5-20R.

3. Standards: Comply with UL 498 and FS W-C-596.

B. Weather-Resistant Duplex Receptacle, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.

2. Configuration: NEMA WD 6, Configuration 5-20R.

3. Standards: Comply with UL 498.

4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

2.3 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A:

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.

2. Configuration: NEMA WD 6, Configuration 5-20R.

3. Type: Feed through.

4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

5. Weatherproof Cover: GFCI receptacles located outdoors shall be installed with an in-use weatherproof cover as described by NEC 406.9(B).

2.4 TOGGLE SWITCHES, 120/277 V, 20 A

A. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

B. Comply with UL 20.

2.5 WALL-SWITCH OCCUPANCY SENSORS

A. Wall Switch Sensor Light Switch, Dual Technology:

1. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology. Digital Lighting Management System and can be connected to any load (s) associated with DLM controllers.

2. Standards: Comply with UL 20.

3. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.

4. Adjustable time delay of 15 minutes.

5. Able to be locked to Automatic-On mode.

6. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc.

7. Provide dimmable type where indicated.

2.6 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting.

3. Material for Unfinished Spaces: Galvanized steel.

4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

5. Material for Chemical Storage, Handling and Metering Locations: Gray PVC with spring-loaded lift cover, and listed and labeled for use in wet and damp locations. Where used for specified metering pumps, provide an in-service Type 3R cover.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.

4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.

b. Straighten conductors that remain and remove corrosion and foreign matter.

c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.

6. Use a torque screwdriver when a torque is recommended or required by manufacturer.

7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.

8. Tighten unused terminal screws on the device.

9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

3.2 GFCI RECEPTACLES

A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Tests for Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.

2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.

3. Ground Impedance: Values of up to 2 ohms are acceptable.

4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

5. Using the test plug, verify that the device and its outlet box are securely mounted.

6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION

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SECTION 262816 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.

2. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.

2. Current and voltage ratings.

3. Short-circuit current ratings (interrupting and withstand, as appropriate).

4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.

2. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Data: Certificates, for enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.

2. Altitude: Not exceeding 6600 feet.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with NFPA 70.

2.3 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Electrification Products Division.

2. Eaton.

3. Siemens Industry, Inc., Energy Management Division.

4. Square D; Schneider Electric USA.

B. Type HD, Heavy Duty:

1. Single or Double throw, as indicated.

2. Three pole or two pole, as indicated or required for the application.

3. 240 or 600-V ac, as indicated or required for the application.

4. 1200 A and smaller.

5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.

6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

4. Auxiliary Contact Kit, where indicated: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 120-V ac.

5. Lugs: Mechanical type, suitable for number, size, and material of conductor.

6. Service-Rated Switches: Labeled for use as service equipment, where indicated or required for the application.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steel.

C. Conduit Entry: Enclosures shall contain no knockouts.

D. Operating Mechanism: The circuit-breaker operating handle shall be directly operable through the dead front trim of the enclosure. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

E. Enclosure shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Engineer and Owner no fewer than seven (7) days in advance of proposed interruption of electric service.

2. Indicate method of providing temporary electric service.

3. Do not proceed with interruption of electric service without Owner's written permission.

4. Comply with NFPA 70E.

3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

1. Indoor, dry and clean locations: NEMA 250, Type 12.

2. Outdoor locations: NEMA 250, Type 3R.

3. Corrosive locations: NEMA 250, Type 4X, stainless steel.

4. Indoor hazardous locations as indicated on Drawings: NEMA 250, Type 7 with cover attached by type 316 stainless steel bolts.

5. Outdoor hazardous locations as indicated on Drawings: NEMA 250, Type 8 with cover attached by type 316 stainless steel bolts.

3.4 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Install fuses in fusible devices.

F. Comply with NFPA 70 and NECA 1.

3.5 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.6 FIELD QUALITY CONTROL

A. Contractor shall perform tests and inspections as follows.

B. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.

b. Inspect anchorage, alignment, grounding, and clearances.

c. Verify that the unit is clean.

d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.

e. Verify that fuse sizes and types match the Specifications and Drawings.

f. Verify that each fuse has adequate mechanical support and contact integrity.

g. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.

i. Verify correct phase barrier installation.

j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole.

Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.

d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.

e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

C. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.

b. Inspect physical and mechanical condition.

c. Inspect anchorage, alignment, grounding, and clearances.

d. Verify that the unit is clean.

e. Operate the circuit breaker to ensure smooth operation.

f. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

g. Inspect operating mechanism, contacts, and chutes in unsealed units.

h. Perform adjustments for final protective device settings if provided.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to

values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.

c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.

e. Determine the following by primary current injection:

1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.

f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.

g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.

h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free,

anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.

i. Verify operation of charging mechanism. Investigate units that do not function as designed.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

1. Test procedures used.

2. Include identification of each enclosed switch and circuit breaker tested and describe test results.

3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges to values if provided.

END OF SECTION

SECTION 264313 SURGE PROTECTION DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Type 2 surge protective devices.

2. Enclosures.

3. Conductors and cables.

1.3 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), Modes of Protection, or Protection Modes: Electrical paths where the SPD offers defense against transient overvoltages. Examples include line to neutral (L-N), line to ground (L-G), line to line (L-L), and neutral to ground (N-G).

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. NRTL: Nationally recognized testing laboratory.

F. OCPD: Overcurrent protective device

G. SCCR: Short-circuit current rating.

H. SPD: Surge protective device.

I. Type 2 SPDs: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.

J. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include electrical characteristics, specialties, and accessories for SPDs.

2. Certification of compliance with UL 1449 by NRTL including the following information:

a. Tested values for VPRs.

b. Inominal ratings.

c. MCOV, type designations.

d. OCPD requirements.

e. Manufacturer's model number.

f. System voltage.

g. Modes of protection.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer’s special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer’s Warranty: Manufacturer agrees to repair or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TYPE 2 SURGE PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB (Electrification Products Division).

2. Eaton.

3. Schneider Electric USA, Inc.

4. Siemens Industry, Inc., Energy Management Division.

B. Source Limitations: Obtain devices from single source from single manufacturer.

C. Standards:

1. Listed and labeled by an NRTL acceptable to authorities having authority as complying with UL 1449, Type 2.

2. Comply with UL 1283.

D. Product Options:

1. Include LED indicator lights for power and protection status.

2. Include internal thermal protection that disconnects the SPD before damaging internal suppressor components.

3. Include NEMA ICS 5, dry Form C contacts rated at 2 A and 24 V ac for remote monitoring of protection status.

4. Include surge counter.

E. Performance Criteria:

1. MCOV: Not less than 125 percent of nominal system voltage for 208Y/120 V and 120/240 V power systems, and not less than 115 percent of nominal system voltage for 480Y/277 V power systems.

2. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase must not be less than 100 kA. Peak surge current rating must be arithmetic sum of the ratings of individual MOVs in each mode.

3. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits must not exceed the following:

a. Line to Neutral: 1200 V for 480Y/277 V.

b. Line to Ground: 1200 V for 480Y/277 V.

c. Neutral to Ground: 1200 V for 480Y/277 V.

d. Line to Line: 2000 V for 480Y/277 V.

4. SCCR: Equal or exceeding 100 kA.

5. Inominal Rating: 20 kA.

2.2 ENCLOSURES

A. Unless otherwise indicated in Drawings, NEMA rating of enclosure shall be as follows:

1. Indoor, Non-Corrosive Environment: NEMA 250, Type 1.

2. Indoor, Corrosive Environment: Type 4X SS

3. Outdoor: Type 3R

2.3 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Provide OCPD and disconnect for installation of SPD in accordance with UL 1449 and manufacturer's written instructions.

C. Install leads between disconnects and SPDs short, straight, twisted, and in accordance with manufacturer's written instructions. Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

1. Do not splice and extend SPD leads unless specifically permitted by manufacturer.

2. Do not exceed manufacturer's recommended lead length.

3. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Compare equipment nameplate data for compliance with Drawings and the Specifications.

2. Inspect anchorage, alignment, grounding, and clearances.

3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. SPDs that do not pass tests and inspections will be considered defective.

C. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Complete startup checks in accordance with manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests; reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

END OF SECTION

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SECTION 312000 EARTH MOVING

GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Preparing subgrades for buildings, structures, slabs-on-grade, walks, pavements, turf and grasses, and plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subbase and base courses for concrete walks, and pavements and asphalt paving.
5. Subsurface drainage backfill for walls and trenches.
6. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Sections:

Division 03 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.

2. Divisions 26 and 33 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
3. Division 31 Section "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above and below-grade improvements and utilities.
4. Division 32 Section "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.

1.3 SITE CONDITIONS

A. Site Information: Unless otherwise indicated in the Contract Documents, no subsurface test results are available for this project. Test borings and other exploratory operations may be undertaken by the Contractor at their own expense, provided such operations are acceptable to the Owner and authorities having jurisdiction.

B. The Contract Documents may contain a Geotechnical Report in the appendix of these documents. When that is the case, all recommendations contained in the Geotechnical Report shall be implemented by the Contractor as described in that document.

C. Where boring logs and related information are included in the Geotechnical Report, this information depicts approximate subsurface conditions only at these specific locations and at the particular time designated on the logs. Subsurface conditions at other locations may differ from those reported at the boring locations. It is expressly understood that neither the Owner nor the Engineer will be responsible for interpretations or conclusions drawn from the boring data by the Contractor. The data are made available for the convenience of the Contractor. Additional test borings and other exploratory operations may be undertaken by the Contractor at his own expense provided such operations are acceptable to the Owner and authorities having jurisdiction.

1.4 DEFINITIONS

Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Cohesionless Materials: Include poorly and well graded gravels (GP and GW) and poorly and well graded sands (SP and SW). Cohesionless soils are generally regarded as free draining.

F. Cohesive Materials: Clayey gravels (GC), clayey sands (SC), lean clays (CL), fat clays (CH), silts (ML and MH), and organic (GM) and silty sands (SM) will be considered cohesionless only when the fines have a plastic index of 0. Otherwise they will be considered cohesive.

Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

H. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated for footings, foundations, pipework and other construction as shown on the Drawings.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices or changes in the Work as appropriate.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

I. Fill: Soil materials used to raise existing grades.

Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179.

Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.
Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

L. Select Backfill: Backfill and fill material that is transported to the site from outside the project limits, and which meets the soil requirements specified herein as satisfactory materials. Material excavated in conjunction with the construction of this project cannot be considered as “select backfill” for payment purposes.

M. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

N. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

O. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

P. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 SUBMITTALS

Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Flowable Fill (Controlled low-strength material), including design mixture.
3. Warning tapes.

Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

Classification according to ASTM D 2487.

2. Laboratory compaction curve according to ASTM D 698.

Blasting plan approved by authorities having jurisdiction.

D. Seismic survey report from seismic survey agency.

E. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.6 QUALITY ASSURANCE

Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:

1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures shall be provided and paid for by the Contractor to perform the following services:

1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and

procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

Geotechnical Testing Agency: A geotechnical testing firm will be selected by the Owner to provide construction material testing services as required for the project.

D. All work associated with this Section shall comply with latest edition of the North Carolina Department of Transportation, Standard Specifications for Roads and Structures where those requirements are more stringent than those specified herein.

E. All work associated with this Section shall comply with the latest edition of the North Carolina Department of Environment and Natural Resources, Erosion and Sediment Control Planning and Design Manual.

F. Comply with all pollution control rules, regulations, ordinances, and statutes which apply to any work performed under the Contract, including any air pollution control rules, regulations, ordinances and statutes, or any municipal regulations pertaining to air pollution.

G. During the progress of the work, maintain the area of activity, including sweeping and sprinkling of streets as necessary, so as to minimize the creation and dispersion of dust. If the Engineer determines that it is necessary to use calcium chloride or more effective dust control, furnish and spread the material, as directed, and without additional compensation.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Engineer.

Utility Locator Service: Notify appropriate utility locator services for area where Project is located before beginning earth moving operations.

Do not commence earth moving operations until tree and plant-protection measures are in place.

The following practices are prohibited within protection zones:

Storage of construction materials, debris, or excavated material.

2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Borrow material shall be selected to meet the requirements and conditions of the particular fill for which its use is intended. Sand clay soils shall be capable of being readily shaped and compacted to the required densities, and shall be free of roots, trash, and other deleterious material. Unless specifically provided, no borrow shall be obtained within the limits of the project site without written approval. Borrow shall meet the same requirements as other onsite materials as specified herein.

C. The Contractor shall place only borrow material that has been specifically identified as acceptable for this section, unless otherwise directed by the Engineer.

Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, CL, ML, and SM according to ASTM D 2487 or Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of masonry, rock or boulders larger than 4 inches in any dimension, and free of metal, gypsum, lime, debris, waste, frozen materials, vegetation, and other deleterious matter, unless otherwise specified.

Organically contaminated soils must be removed from the area of grading operations. At the discretion of the Engineer, topsoil within the area to be stripped shall be stockpiled in a convenient area, selected by the Engineer, for later use in planting areas. All topsoil shall be graded by the Engineer as suitable and shall be stockpiled separately as directed by the Engineer in the field.

2. Soft or excessively yielding material shall be removed and replaced with inert controlled fill.
3. All roots, organic matter, trash, debris, and other unsuitable materials that may find their way into otherwise acceptable fill material shall be removed during the dumping and spreading operations.
4. Fill material shall have a minimum laboratory dry weight, ASTM D-698, of at least 100 pounds per cubic foot unless specifically exempted from this requirement by the Engineer.

E. Unsatisfactory Soils: Soil Classification Groups GC, SC, OL, CH, MH, OH, and PT according to ASTM D 2487 and Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups, unless otherwise specified.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

I. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

J. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

K. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

L. Pipe Bedding: Narrowly graded washed crushed stone or crushed gravel meeting the requirements of ASTM D 448, aggregate grading size 57.

M. Sand: ASTM C 33; fine aggregate.

N. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

Survivability: Class 2; AASHTO M 288.

Grab Tensile Strength: 157 lbf; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
4. Tear Strength: 56 lbf; ASTM D 4533.
5. Puncture Strength: 56 lbf; ASTM D 4833.

Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
Permittivity: 0.2 per second, minimum; ASTM D 4491.
UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

Survivability: Class 2; AASHTO M 288.

Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.

Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 FLOWABLE FILL (CONTROLLED LOW-STRENGTH MATERIAL)

A. Flowable Fill (controlled low-strength material) shall meet the requirements of NCDOT Standard Specifications for Roads and Bridges, (latest revision). Flowable fill shall have a minimum 28-day compressive strength of 125 psi and shall be mixed such that cement content is 100 to 150 pounds per cubic yard, air content is less than 35 percent and slump is between 7 and 9 inches.

2.4 ACCESSORIES

Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:

Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Locate existing underground utilities in the area of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Engineer immediately for directions as to procedure. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of utility companies.

C. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

D. Do not commence earth moving operations until temporary erosion and sedimentation control measures, as shown on the plans, as specified herein or as may be required by authorities having jurisdiction are in place.

E. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface. Shape the subgrade as indicated on the drawings by forking, furrowing, or plowing so that the first layer of new material placed thereon will be well bonded to it.

F. After removal of all existing topsoil, debris, and other undesirable material, the areas which are to receive fill, which have been cut to the desired grade, or which are at the approximate required subgrade elevation without additional earthwork, should be proofrolled to locate any soft or yielding area. Proofrolling shall be done as described below.

G. Any soft or excessively yielding material revealed by the proofrolling shall be removed and replaced with inert controlled fill. The Engineer shall be the sole judge of what constitutes soft or excessively yielding material.

H. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 CUTTING CONCRETE OR ASPHALT SURFACE CONSTRUCTION

A. All pavement cutting and repair shall be done in accordance with the requirements of authorities having jurisdiction. Cuts in concrete and asphaltic concrete shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be performed with a concrete saw in a manner which will provide a clean groove the complete thickness of the surface material along each side of the trench and along the perimeter of cuts for structures.

B. Concrete and asphaltic concrete over trenches excavated for pipelines shall be removed so that a shoulder not less than 12 inches in width at any point is left between the cut edge of the surface and the top edge of the trench. Trench width at the bottom shall not be greater than at the top and no undercutting will be permitted. Cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the center line of the trench.

C. Pavement or other surfaces removed for connections to existing lines or structures shall not be of greater extent than necessary for the installation.

D. Where the trench parallels the length of concrete walks and the trench location is all or partially under the walk, the entire walk shall be removed and replaced. Where the trench crosses drives, walks, curbs, or other surface construction, the surface construction shall be removed and replaced between existing joints or between saw cuts.

3.3 DEWATERING

A. The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface water and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

B. All excavations for concrete structures or trenches that extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level beneath such excavations 12 inches or more below the bottom of the excavation.

C. The Contractor is responsible for obtaining any required permits or permissions necessary for the disposal of groundwater that is removed. Any discharged groundwater shall be clean and free of sediment.

D. The Contractor shall be responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.

E. The Contractor shall take special care to prevent the siltation of streams and remove all organically contaminated sediment, saturated soil, and other undesirable material from existing watercourses.

F. Prevent surface water and ground water from entering or accumulating in trenches and other excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area. Do not use excavated trenches as temporary drainage ditches. Divert water from these areas without causing damage to adjacent property.

G. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

3.4 EXPLOSIVES

A. Where blasting is permitted, it shall be done only by qualified personnel and in accordance with all requirements of authorities having jurisdiction. The Contractor shall be responsible for any damage done to adjacent structures, properties, or to persons, by reason of the blasting or other earthwork operations. The Contractor shall also be responsible for damage to other site improvements including, but not limited to embankments and cut areas, and sewer, water, gas or other underground lines which may result from blasting or earthwork operations. All such damage shall be repaired and made good by the Contractor in a timely manner.

B. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation or trench.

C. All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed.

D. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

E. Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.

3.5 EXCAVATION, GENERAL

A. Perform all excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Furnish, put in place, and maintain such sheeting, bracing, etc., as may be necessary to support the sides of the excavation to comply with the requirements of governing authorities having jurisdiction.

C. Protect structures, utilities, sidewalks, pavements, and other facilities from damages caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

D. The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

E. Widening of cuts or flattening of cut slopes will not be required in rock or material which required ripping. When rock is unexpectedly encountered, any widening or flattening already begun shall be transitioned to leave the cut with a pleasing and safe appearance.

Unclassified Excavation: Excavate to subgrade elevations regardless of the character, nature or composition of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

24 inches outside of concrete forms other than at footings.

b. 12 inches outside of concrete forms at footings.
c. 6 inches outside of minimum required dimensions of concrete cast against grade.
d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
e. 6 inches beneath bottom of concrete slabs-on-grade.
f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

G. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth or rock. When rock is encountered within the limits of construction, the Contractor shall notify the Engineer prior to any removal. Upon the Engineer's authorization, the Contractor shall remove the rock. The Contractor shall not be paid for rock removed without prior approval from the Engineer.

Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

24 inches outside of concrete forms other than at footings.

b. 12 inches outside of concrete forms at footings.
c. 6 inches outside of minimum required dimensions of concrete cast against grade.
d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
e. 6 inches beneath bottom of concrete slabs-on-grade.
f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.6 EXCAVATION FOR STRUCTURES

Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.

3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.7 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate and shape the surface of areas under walks to indicated lines, grades, elevations, subgrades and cross sections, with the finish surface not more than 0 inches above or 1 inch below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains.

B. Excavate and shape the surface of areas under pavement to indicated lines, grades, elevations, subgrades and cross sections, with the finish surface not more than 1/2 inch above or below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains. Include such operations as plowing, discing, and any moisture or aerating required to provide the optimum moisture content for compaction.

C. Fill low areas resulting from removal of unsatisfactory soil materials, obstructions, and other deleterious materials, using satisfactory soil material.

3.8 EXCAVATION FOR UTILITY TRENCHES

Perform all excavation of every description and of whatever substance encountered so that the pipe can be laid to the indicated gradients, lines, depths, and elevations shown on the drawings.

B. Except where tunneling is indicated on the drawings, is specified, or is permitted by the Engineer, all trench excavation shall be open cut from the surface.

C. No more trenches shall be opened in advance of pipe laying than is necessary to expedite the work. One block or 400 feet (whichever is the shorter) shall be the maximum length of open trench on any line under construction.

D. Mechanical equipment used for trench excavation shall be of a type, design, and construction and shall be controlled, such that uniform trench widths and vertical sidewalls are obtained at least from an elevation one foot above the top of the installed pipe to the bottom of the trench, and that trench alignment is such that pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

E. Where pipe grades or elevations are not definitely fixed by the contract drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe. Cover depths may be necessary on vertical curves or to provide necessary clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation except where future surface elevations are indicated on the drawings.

F. Excavate trenches to uniform widths to provide a maximum trench width no greater than the pipe outside diameter plus 24 inches (12 inches on either side of pipe). Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated. Do not widen trenches by scraping or loosening materials from the sides.

Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit to be bedded in earth excavated trenches, fine grade the bottoms of such trenches to allow firm bearing for the bottom of the pipe on undisturbed earth. Where any part of the trench has been excavated below the grade of the pipe, fill the part excavated below such grade with pipe bedding material and compact at the Contractor's expense.
2. For pipes and conduit to be laid in embankments or other recently filled material, first place the fill material to the finish grade or to a height of at least one foot above the top of the pipe, whichever is the lesser. Take particular care to ensure maximum consolidation of material under the pipe location. Excavate the pipe trench as though in undisturbed material.
3. For trench bottoms in poor soils excavate and remove unstable or unsuitable soil to a width and depth, as directed by the Engineer, and refill with a thoroughly compacted gravel bedding.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

I. Where trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed.

3.9 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. Subgrades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; free from mud and muck; and sufficiently stable to remain firm and intact under the feet of the workmen.

C. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

D. Subgrades for concrete structures or trench bottoms, which are otherwise solid but which become mucky on top due to construction operations, shall be reinforced with one or more layers of crushed rock or gravel. The stabilizing material shall be spread and compacted to a depth of not less than 6 inches below the bottom of the structure or pipe. Not more than ½ inch depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon. The finished elevation of stabilized subgrades for concrete structures shall not be above subgrade elevations indicated on the drawings.

Proof-roll subgrade below structures, slabs, pavements and other areas as directed by Engineer. Proofrolling shall be done with at least four (4) overlapping passes of a heavy-duty flat wheel vibratory roller, at least 20 tons, or by its approved equivalent.

F. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction (longest dimension of Project). Limit vehicle speed to 3 mph.

2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

G. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.10 UNAUTHORIZED EXCAVATION

Unauthorized excavation consists of the removal of materials beyond indicated lines, grades, or elevations without the specific direction of the Engineer.

B. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Additional concrete to fill unauthorized excavations shall be placed, by and at the expense of the Contractor, with concrete placed at the same time and monolithic with the concrete above.

C. For pipe trenches and elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of the same classification, unless otherwise directed by the Engineer.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.

2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.

7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.13 UTILITY TRENCH BACKFILL

A. Unless otherwise specified or indicated on the drawings, use suitable material for backfill which was removed in the course of making the construction excavations. Do not use frozen material for the backfill and do not place backfill on frost, snow, ice or frozen or muddy material. Remove previously frozen material before new backfill is placed. Start backfilling as soon as practicable after the pipes have been laid, or the structures have been built and are structurally adequate to support the loads, including construction loads to which they will be subjected, and proceed until its completion.

B. With the exception mentioned below in this paragraph, do not backfill trenches at pipe joints until after that section of the pipeline has successfully passed any specified tests required. Should the Contractor wish to minimize the maintenance of lights, and barricades, and the obstruction of traffic, he may, at his own risk, backfill the entire trench as soon as practicable after installation of pipe, and the related structures have acquired a suitable degree of strength. He shall, however, be responsible for removing and later replacing such backfill, at his own expense, should he be ordered to do so in order to locate and repair or replace leaking or defective joints or pipe.

C. Do not drop large masses of backfill material into the trench in such a manner as to endanger the pipeline. Use a timber grillage to break the fall of material dropped from a height of more than 5 feet. Exclude pieces of bituminous pavement from the backfill unless their use is expressly permitted.

D. Zone Around Pipe: Place bedding material to the level shown on the Drawings and work material carefully around the pipe to insure that all voids are filled, particularly in bell holes. For backfill up to a level of 2 feet over the top of the pipe, use only selected materials containing no rock, clods or organic materials. Place the backfill and compact thoroughly under the pipe haunches and up to the mid line of the pipe in layers not exceeding 6 inches in depth. Place each layer and tamp carefully and uniformly so as to eliminate the possibility of lateral displacement. Place and compact the remainder of the zone around the pipe and to a height of one foot above the pipe in layers not exceeding 6 inches and compact to a maximum density of at least 100 percent as determined by ASTM D698.

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Tamping: Deposit and spread backfill materials in uniform, parallel layers not exceeding 12 inches thick before compaction. Tamp each layer before the next

layer is placed to obtain a thoroughly compacted mass. Furnish and use, if necessary, an adequate number of power driven tampers, each weighing at least 20 pounds for this purpose. Take care that the material close to the bank, as well as in all other portions of the trench, is thoroughly compacted. When the trench width and the depth to which backfill has been placed are sufficient to make it feasible, and it can be done effectively and without damage to the pipe, backfill may, on approval of the Engineer, be compacted by the use of suitable rollers, tractors, or similarly powered equipment instead of by tamping. For compaction by tamping (or rolling), the rate at which backfilling material is deposited in the trench shall not exceed that permitted by the facilities for its spreading, leveling and compacting as furnished by the Contractor.

G. Follow the measures described herein to ensure the optimum moisture content of the backfill material prior to placement in the trench. Perform no compaction by tamping (or rolling) when the material is too wet either from rain or applied water to be compacted properly.

H. Compact backfill in pipe trenches to the maximum density as shown on the drawings, or as specified herein.

Flowable Fill (Controlled Low-Strength Material): Place initial backfill of flowable fill to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

Place and compact final backfill of satisfactory soil to final subgrade elevation.

Install warning tape directly above utilities as shown on the Drawings.

3.14 SOIL FILL

A. After a stable, non-yielding surface has been established, the surface of the area to be filled shall be scarified with a disc or harrow to a depth of 4 to 6 inches. An initial 3-inch layer of fill material shall then be spread over the scarified surface and the entire area compacted as specified below.

B. No fill shall be placed on any area until that area has been inspected and approved by the Engineer. Fill shall not be placed mud, frost, snow or ice. Fill materials shall be spread in uniform horizontal layers not exceeding 8 inches in uncompacted thickness. Alternating layers of cohesive and granular fill soils shall not be permitted. Spreading and compacting of fill material should be started at the lowest portion of the site. All fill must be placed in horizontal layers. Sloping fill planes will not be permitted. Fill material shall be distributed over the full width of the embankment, and in no case will deep ruts be allowed to form.

C. Keyways shall be provided at the toe of each fill slope as shown on the drawings. As each layer of fill meets the natural grade of a slope, a bench, approximately 7 to 8 feet wide, shall be cut into the existing grade with each layer of newly placed fill. If rock is encountered at the face of the natural grade, the original ground

shall be cut in vertical steps of 4 to 5 feet and a horizontal bench cut into the rock at the top of each vertical increment. A horizontal plateau, approximately 15 to 20 feet wide, should be provided in the existing slope at vertical intervals of roughly 25 feet. Subsurface drains shall be installed at the toe of the slope and wherever springs or excessive seepage are encountered. Drains should be led to the outside face of the embankment and the water picked up and carried away in such a manner as to avoid softening the embankment or its toe, or producing erosion gullies.

D. Place and compact fill material in layers to required elevations as follows:

Under grass and planted areas, use satisfactory soil material.

2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.

Under footings and foundations, use engineered fill.

3.15 SOIL MOISTURE CONTROL

A. Before compaction begins, the fill shall be brought to a water content that will permit proper compaction. This may require aerating the material if it is too wet or the addition of water if it is too dry. If additional water is required, it should be uniformly distributed through the use of approved water wagons, and shall be thoroughly incorporated into the material by means of discs or other suitable mixing equipment. Care shall be taken to avoid trapping water within the fill.

B. Where, in the opinion of the Engineer, proposed fill material is too wet to permit drying in a reasonable length of time, the Engineer may reject the material and it must be removed from the work area.

C. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

D. Method “C” of the Standard Proctor test of moisture density relationship test, ASTM D 698 or AASHTO T99, shall be used to determine the maximum laboratory dry density and the optimum moisture content of the material which is to be used for fill.

3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

Place satisfactory backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place satisfactory backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. Do not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking, or other damage. Take care to prevent wedging action of backfill against structures.

C. Make special leakage tests, if required, as soon as practicable after the structures are structurally adequate and other necessary work has been done. Use the best of the excavated materials in backfilling within 2 feet of the structure.

D. When existing ground surface has a density less than that specified under the subsection entitled “COMPACTION” for the particular area classification, break up the ground surface, pulverize, moisture condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

E. After compaction, all fill will be tested in accordance with Method "C" of ASTM D-698, unless specified otherwise. Except as noted otherwise for the zone around pipe, provide not less than the following percentages of maximum density of soil material compacted at optimum moisture content, for the actual density of each layer of soil material-in-place:

UNPAVED AREAS	Compact Full Depth to 92%
DRIVES AND PARKING	Top 24” - 100%
TRENCH BACKFILL (PAVED AREAS)	Compact full depth to 100%
TRENCH BACKFILL (UNPAVED AREAS)	Compact full depth to 95%
ALL OTHER BACKFILL	Compact full depth to 95%

F. The above compaction requirements are to be satisfied for all soil and weathered or soft rock fills. Weathered or soft rocks are those that can be broken down and disintegrated under normal compaction procedures and equipment.

G. At the close of each day's work, or where work is to be interrupted for a period of time, the surface of the site shall be shaped to drain freely, and sealed. If after a prolonged rainfall, the surface of the area to be filled or cut is too wet to work properly, the unsuitable material shall be removed to expose workable soil. The wet material removed may be dried and reused. Construction traffic shall be controlled so as to prevent rutting of graded areas and to avoid over-rolling of any section.

H. All cut areas shall be rolled and compacted to produce a compaction equal to that of the filled area. If soft or yielding material is encountered in cuts, or fills as a

result of trapping water, over-rolling or improper control of construction traffic, and cannot be satisfactorily stabilized by moisture control, compaction or other means approved by the Engineer, the unstable material shall be excavated to the depth required by the Engineer. The excavation shall then be filled with suitable compacted material in accordance with the requirements outlined above.

GRADING

A. Elevations shown on the plans are finished ground unless otherwise noted. Grading shall be maintained in such a manner as to provide free surface drainage away from structures and throughout the site at all times without any ponding of water.

B. Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

C. Provide ditches and swales to the cross sections and grades shown on the drawings. Cut ditch subgrades 4 inches below the grades shown and provide 4 inches of topsoil where the plans call for seeding or sodding of the ditch. Keep ditches and swales free of accumulations of debris or washed in material until final acceptance of work by the Engineer.

D. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

Turf or Unpaved Areas: Plus or minus 1 inch.

2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

E. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.18 SUBSURFACE DRAINAGE

Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

Place and compact impervious fill over drainage backfill in 6-inch thick compacted layers to final subgrade.

3.19 BASE COURSES UNDER PAVEMENTS AND WALKS

Place base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place base course under pavements and walks as follows:

Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

2. Place base course material over subbase course under hot-mix asphalt pavement.

Shape base course to required crown elevations and cross-slope grades.

4. Place base course 6 inches or less in compacted thickness in a single layer.
5. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
6. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

Pavement Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

2. Place drainage course 6 inches or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.21 FIELD QUALITY CONTROL

A. The services of qualified soils testing personnel may be engaged by the Owner for the making of tests to determine the moisture-density relationships, relative densities, plastic and liquid limits and suitability of materials for compaction and for inspection and control of the site preparation, selection, placing and compaction of the fill. Such tests will be provided and paid for by the Owner, except that tests which reveal non-conformance with the Specifications and all succeeding tests for the same area, until conformance with the Specifications is established shall be at the expense of the Contractor. The Owner will be responsible for paying for only the successful tests. A copy of the testing personnel's daily field report including results of in-place density and moisture content tests should be forwarded to the Owner and the Engineer at the end of each working day.

B. The Contractor shall cooperate fully with the testing personnel so as to permit proper inspection and control of the work without unnecessary delays.

When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.22 PROTECTION

A. Do not operate tractors, bulldozers or other power operated equipment on paved surfaces if the treads or wheels of the equipment are so shaped as to cut or otherwise injure the surfaces.

B. Restore all surfaces, including lawns, grassed, and planted areas that have been injured by the Contractor’s operations, to a condition at least equal to that in which they were found immediately before the work was begun. Use suitable materials and methods for such restoration. Maintain all restored plantings by cutting, trimming, fertilizing, etc., until acceptance. Restore existing property or structures as promptly as practicable and do not leave until the end of construction period.

C. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

D. During construction and until final acceptance, the Contractor shall construct temporary or permanent earth berms along the outer edges of the top surface of the embankment, construct temporary ditches, shape the embankment surface to provide for the drainage of surface runoff along and throughout the length of the embankments, and use any other methods necessary to maintain the work covered by this section so that the work will not contribute to excessive soil erosion. The Contractor shall construct brush dikes, or install temporary or permanent slope drains or other drainage features to assist in controlling erosion.

E. Slides and overbreaks which occur prior to final acceptance of the project due to natural causes shall be removed and disposed of by the Contractor as directed by the Engineer.

F. Where slides or overbreaks occur due to negligence or carelessness on the part of the Contractor, the Contractor shall remove and dispose of the material at no cost to the Owner.

G. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

H. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

I. All embankments shall be brought to the grade and cross section shown on the plans or established by the Engineer, prior to final inspection and acceptance by the Engineer.

3.23 MAINTENANCE

A. The Contractor shall be responsible during construction and until final acceptance for the maintenance of all embankments, ground covers and other surfaces made under the Contract.

B. The Contractor shall protect and maintain erosion and sedimentation controls during earth moving operations and shall remove said measures upon completion

of earth moving operations and the satisfactory establishment of permanent or temporary ground covers.

3.24 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property unless otherwise required by the plans or special provisions or unless disposal within the project area is permitted by the Engineer.

B. Concrete that is painted must be disposed of in accordance with requirements and regulations of the North Carolina Department of Environment and Natural Resources (NCDENR) Solid Waste Section. Prior to disposal of painted concrete, the Contractor shall submit a written certification to NCDENR that the paint on the concrete is not lead-based. Certification that paint on concrete is not lead-based paint is required prior to management as inert debris. Lead-based paint is defined by federal statute (Title X of the Housing and Community Development Act and the Toxic Substances Control Act, by reference). Concrete that is painted with lead-based paint, or paint that has not been certified to the satisfaction of the NCDENR Solid Waste Section to be below the federal standard to be considered lead-based paint, must be disposed of at a properly permitted construction and demolition landfill or a permitted municipal solid waste landfill.

C. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.

D. The Contractor shall maintain the earth surfaces of all waste areas, both during the work and until the completion of all seeding and mulching or other erosion control measures specified, in a manner which will effectively control erosion and siltation.

E. The following requirements shall also be applicable to all waste or disposal areas other than active public waste or disposal areas:

1. Rock waste shall be shaped to contours which are comparable to and blend in with the adjacent topography where practical, and shall be covered with a minimum 6 inch thick layer of earth material either from the project waste or from borrow.
2. Earth waste shall be shaped to contours which are comparable to and blend in with the adjacent topography where practicable, but in no case will slopes steeper than 2:1 be permitted.
3. Construction debris, grubbed debris and all broken pavement and masonry shall be covered with a minimum 6-inch thick layer of earth waste material from the project or borrow. The completed waste area shall be shaped as required above for disposal of earth waste.

4. Seeding and mulching shall be performed over all earth or earth covered waste areas. The work of seeding and mulching shall be performed in accordance with other sections of these Contract Documents.
5. Where the Engineer has granted permission to dispose of waste and debris within the project, the Engineer will have the authority to establish whatever additional requirements may be necessary to insure the satisfactory appearance of the completed project.

END OF SECTION 312000

SECTION 312230 AGGREGATE BASE COURSE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work covered by this section consists of the construction of a base composed of an approved aggregate material hauled to the site, placed on the site, compacted, and shaped to conform to the lines, grades, depths, and typical sections shown on the plans or established by the Engineer.

B. Related Sections:

1. Division 31 Section “Earth Moving”.
2. Division 32 Section “Bituminous Paving”.
3. Division 33 Section “Storm Drainage Materials”.

1.3 PERFORMANCE REQUIREMENTS

A. The work under this section consists of furnishing all materials, labor, equipment, incidentals and services required for the complete installation of aggregate base course materials in the locations shown on the drawings and as specified herein.

B. All work in connection with installing aggregate base course materials shall comply with all current requirements of authorities having jurisdiction. The Contractor is responsible for being familiar with and adhering to these requirements.

C. The Contractor shall inspect the locations of the proposed work associated with this Section and shall familiarize themselves with the conditions under which the work will be performed, and with all necessary details and the suitability of their equipment and methods for the work required. The omission of any installation details which may not appear within the Contract Documents shall not relieve the Contractor of full responsibility for completing the work as necessary.

D. Construction shall be done in such a manner that will not interfere with the operation of any street, highway, railway, or other facility nor weaken or damage any embankment or structure. Barricades and lights shall be furnished and

maintained to safeguard traffic and pedestrians as required by authorities having jurisdiction until such time as the operation has been completed.

1.4 SUBMITTALS

A. Product Data and certificates: For all aggregate base course materials.

1.5 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall utilize methods of handling, hauling, and placing which will minimize segregation and contamination of the aggregate used for the base course. If segregation occurs, the Engineer may require that changes be made in the Contractor's methods and may also require remixing of the aggregate to achieve the proper mixture. No additional compensation will be made for remixing, additional equipment, or other measures necessary to provide the coarse aggregate base course specified. Aggregate which becomes contaminated with foreign materials to the extent that the base course will not serve its intended use shall be removed and replaced by the Contractor at no additional expense to the Owner. The above requirements will be applicable regardless of the type of aggregate placed and regardless of prior acceptance.

1.6 COORDINATION

A. For all work within the Department of Transportation right-of-way, the Contractor shall notify the appropriate office of the Department of Transportation at least 72 hours prior to beginning construction.

1.7 WARRANTY

A. All materials shall be warranted to be free from defects in workmanship and materials for one (1) year following final acceptance by the Owner.

PART 2 - PRODUCTS

2.1 AGGREGATE BASE COURSE

A. Aggregate base course materials shall consist of crushed stone or uncrushed gravel, or other similar material having hard, strong, durable particles free of adherent coatings meeting the requirements of the NCDOT Standard Specifications for Roads and Structures, latest edition for the project-specific use of the aggregate.

B. The Contractor shall furnish aggregate base course material produced in accordance with the requirements indicated herein for Type A, aggregate unless otherwise specified in the special provisions.

C. All aggregates shall be from approved sources. Sources will not be approved unless the material has satisfactory soundness and satisfactory resistance to abrasion. Satisfactory soundness will be considered to be a weighted average loss of not greater than 15 percent when subjected to five (5) alternations of the sodium sulfate soundness test in accordance with AASHTO T104. Satisfactory resistance to abrasion will be considered to be a percentage of wear of not greater than 55 percent when tested in accordance with AASHTO T96.

D. Aggregates shall be handled in such a manner as to minimize segregation

E. Sites for aggregate stockpiles shall be grubbed and cleaned prior to storing aggregates, and the ground surface shall be firm, smooth, and well drained. A cover of at least 3” of aggregate shall be maintained over the ground surface in order to avoid the inclusion of soil or foreign material. Stockpiles shall be built in such a manner as to minimize segregation. When it is necessary to operate trucks or other equipment on a stockpile in the process of building the stockpile, it shall be done in a manner approved by the Engineer.

F. Stockpiles of different types or sizes of aggregates shall be spaced far enough apart, or else separated by suitable walls or partitions, to prevent the mixing of the aggregates.

G. Any method of stockpiling aggregates which allows the stockpile to become contaminated with foreign matter or causes excessive degradation of the aggregate will not be permitted. Excessive degradation will be determined by sieve tests of samples taken from any portion of the stockpile over which equipment has been operated, and failure of such samples to meet all grading requirements for the aggregate will be considered cause for discontinuance of such stockpiling procedure.

H. Gradation: All standard sizes of aggregates shall meet the gradation requirements when tested in accordance with AASHTO T27.

2.2 WATER

A. Water, if used in construction, shall be potable water, free from oil and other deleterious matter.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

A. The subgrade shall be dry and cleaned of all foreign substances prior to constructing the base course.

B. The surface of the subgrade shall be prepared as specified in Section 312000 “Earth Moving” based on the specified use of the aggregate base course.

3.2 PLACEMENT OF STONE BASE

A. The aggregate material shall be spread on the subgrade to a uniform loose depth and without segregation.

B. Where the required compacted thickness of base is 10 inches or less the base material may be spread and compacted in one layer. Where the required compacted thickness of base is more than 10 inches, the base material shall be spread and compacted in two (2) or more approximately equal layers. The minimum compacted thickness of any one layer shall be approximately 4 inches.

C. Each layer of material shall have been sampled, tested, compacted, and approved prior to placing succeeding layers of base material or pavement. Such tests will be provided and paid for by the Owner, except that tests which reveal non-conformance with the Specifications and all succeeding tests for the same area, until conformance with the Specifications is established shall be at the expense of the Contractor. The Owner will be responsible for paying for only the successful tests. The minimum compaction for each layer shall be 100% standard proctor.

D. No base material shall be placed on frozen subgrade or base. Hauling equipment shall not be operated on subgrade or a previously completed layer of base material soft enough to rut or weave beneath the equipment.

E. The maximum speed of trucks hauling or traveling over any part of the subgrade or base shall be five (5) miles per hour.

3.3 QUALITY CONTROL

A. Weather and Temperature Limitations:

1. Coarse aggregate base course shall not be placed during rainy weather or on wet or frozen subgrade.

2. Stabilized aggregate base courses shall not be constructed when the atmospheric temperature is below thirty-five (35) degrees F. when measured in the shade away from artificial heat.
3. Any areas of completed base course that are damaged by elements such as rain, sleet, snow, hail, or freeze/thaw conditions shall be reconditioned, reshaped, and compacted in accordance with the Drawings and these Specifications.

B. Tolerances:

1. After final shaping and compacting the base, the Engineer will check the surface of the base for conformance to grade and typical section and will determine the base thickness.
2. The thickness of the base shall be within a tolerance of ±1/2-inch of the base thickness required by the plans.

C. Maintenance:

1. Where the base material is placed in a trench section, the Contractor shall provide adequate drainage through the shoulders to protect the subgrade and base until such time as shoulders are completed.

2. The Contractor shall maintain the surface of the base by watering, machining, and rolling or dragging when necessary to prevent damage to the base by weather or traffic.

1. Where the base or subgrade is damaged, repair the damaged area; reshape the base to required lines, grades and typical sections; and recompact the base to the required density at no cost to the Owner.

END OF SECTION 312230

SECTION 312271 RIP RAP

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work to be performed under this Specification shall consist of furnishing and installing all materials and equipment and performing all labor required to install rip rap and associated appurtenances as specified herein.

B. Related Sections:

1. Division 33 Section “Storm Drainage Materials”.

1.3 PERFORMANCE REQUIREMENTS

A. The work under this section consists of furnishing all materials, labor, equipment, incidentals and services required for the complete installation of rip rap and geotextiles materials in the locations shown on the drawings and as specified herein.

B. All work in connection with installing rip rap and associated geotextile materials shall comply with all current requirements of authorities having jurisdiction. The Contractor is responsible for being familiar with and adhering to these requirements.

C. The Contractor shall inspect the locations of the proposed work associated with this Section and shall familiarize themselves with the conditions under which the work will be performed, and with all necessary details and the suitability of their equipment and methods for the work required. The omission of any installation details which may not appear within the Contract Documents shall not relieve the Contractor of full responsibility for completing the work as necessary.

D. Construction shall be done in such a manner that will not interfere with the operation of any street, highway, railway, or other facility nor weaken or damage any embankment or structure. Barricades and lights shall be furnished and maintained to safeguard traffic and pedestrians as required by authorities having jurisdiction until such time as the operation has been completed.

1.4 SUBMITTALS

A. Product Data and certificates: For all rip rap and geotextile materials.

1.5 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall coordinate material deliveries with the manufacturer/supplier. All materials shall be handled and stored in accordance with the manufacturer's recommendations using methods that will prevent damage to the materials.

B. The Contractor shall load, transport, unload and store geotextiles so they are kept clean and free of damage. Label and store geotextiles in accordance with Section 7 of AASHTO M288. Geotextiles with defects, flaws, deterioration or damage will be rejected. Do not unwrap geotextiles until just before installation.

1.6 COORDINATION

A. For all work within the Department of Transportation right-of-way, the Contractor shall notify the appropriate office of the Department of Transportation at least 72 hours prior to beginning construction.

1.7 WARRANTY

A. All materials shall be warranted to be free from defects in workmanship and materials for one (1) year following final acceptance by the Owner.

PART 2 - PRODUCTS

2.1 GEOTEXTILES

A. When indicated for use on the Drawings, geotextiles used in conjunction with the placement of rip rap shall possess the following properties.

1. Elongation: ≥ 50 percent in accordance with ASTM D4632.
2. Grab Strength: 205 pounds in accordance with ASTM D4632.
3. Tear Strength: 80 pounds in accordance with ASTM D4533.
4. Puncture Strength: 440 pounds in accordance with ASTM D6241.
5. Permittivity: 0.20 sec-1 in accordance with ASTM D4491.
6. Apparent Opening Size: #60 in accordance with ASTM D4751.
7. UV Stability (Retained Strength after 500 hours of exposure): 50 percent in accordance with ASTM D4355.

B. When required, sew geotextiles together in accordance with Article X1.1.4 of AASHTO M288. Provide sewn seams with seam strengths meeting the required strengths of the geotextile specified herein.

2.2 RIP RAP

A. Rip rap shall be field stone or rough unhewn quarry stone which is sound, tough, dense, resistant to the action of air and water and suitable in all other respects for the purpose intended. Where broken concrete from demolished structures or pavement is available, it may be used in place of stone provided that such use meets with the approval of the Engineer. However, the use of broken concrete that contains reinforcing steel will not be permitted.

B. All stone shall meet the approval of the Engineer. While no specific gradation is required, there shall be equal distribution of the various sizes of the stone within the required size range. The size of an individual stone particle will be determined by measuring its long dimension.

C. Stone or broken concrete for rip rap shall meet the table below for the class shown on the drawings.

ACCEPTANCE CRITERIA FOR RIP RAP AND STONE FOR EROSION CONTROL			
Class	Minimum	Midrange	Maximum
A	2	4	6
B	5	8	12
1	5	10	17
2	9	14	23

D. No more than 5.0 percent of the material furnished shall be less than the minimum size specified nor no more than 10.0 percent of the material shall exceed the maximum size specified.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

A. The Contractor shall prepare the subgrade such that the finished rip rap surface conforms to the lines, slopes and elevations indicated. The Contractor shall clear the subgrade of sticks, stones, debris and other materials that could puncture the overlying geotextile. The finished subgrade shall not vary from design grade by more than 2 inches at any location.

3.2 PLACEMENT OF GEOTEXTILE

A. The Contractor shall place geotextile material only on subgrade approved by the Engineer in accordance with the recommendations of the material manufacturer.

3.3 PLACEMENT OF RIP RAP

A. The Contractor shall proceed with placing the riprap immediately upon completion of geotextile installation.

B. Rip rap shall be placed on the surface of slopes and at storm drainage pipes at the locations indicated on the plans. Rip rap shall be placed to a minimum depth of 1.5 times the midrange stone size for the class of rip rap specified, but in no case less than 6 inches.

C. Rip rap shall be placed in such a manner as to produce a reasonably well-graded mass with the minimum practicable percentage of voids.

D. Place to full course thickness in one operation in a manner to avoid displacing or puncturing geotextile. Rip rap shall not be dropped from a height greater than one foot above the geotextile.

E. The Contractor may place the rip rap by mechanical methods, augmented by hand placing where necessary, provided that when the rip rap is completed it forms a uniformly graded, dense, neat layer of rip rap of the necessary depth.

F. Unless otherwise indicated or directed by the Engineer, the rip rap shall be placed upon a slope which shall be no steeper than the angle of repose.

END OF SECTION 312271

SECTION 321216 BITUMINOUS PAVING

GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. All work and materials required under this section of the specifications shall conform to the applicable sections of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures and the North Carolina Department of Transportation Pavement Construction Section Superpave Hot Mix Asphalt / Quality Management System.

1.2 SUMMARY

A. Section Includes:

1. Cold milling of existing hot-mix asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt paving overlay.
5. Asphalt surface treatments.
6. Pavement-marking paint.
7. Traffic-calming devices.

B. Related Sections:

Division 02 Sections "Demolition" for demolition, removal, and recycling of existing asphalt pavements.

2. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
3. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

1.3 DEFINITION

Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.4 SUBMITTALS

Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

2. Job-Mix Designs: For each job mix proposed for the Work.

Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples: For each paving fabric, 12 by 12 inches minimum.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

Each paving fabric, 12 by 12 inches minimum.

2. Each type and color of preformed traffic-calming device.
3. Each pattern and color of imprinted asphalt.

Material Certificates: For each paving material, from manufacturer.

Material Test Reports: For each paving material.

G. The Contractor shall furnish copies of certified weight tickets for all asphalt placed on the project. The original of all tickets, including any voided tickets or tickets for rejecting mixture, shall become the property of the Engineer.

1.5 QUALITY ASSURANCE

A. All aspects of the work, including, but limited to materials, equipment, application and installation procedures, quality control, and environmental conditions necessary for application/installation of materials shall be in accordance with the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. Quality control and quality assurance are provided for through use of the Quality Management System, as discussed in Section 1 of the latest edition Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

C. All hot mix asphalt must be provided by a Certified Asphalt Plant, as covered in Section 5.3 of the latest edition Superpave Hot Mix Asphalt/Quality Management

System of the North Carolina Department of Transportation Pavement Construction Section.

D. Asphalt plant equipment and operations shall meet the Specifications set forth in Section 5 and 6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

E. Delivery and Acceptance of Asphalt Materials must conform to Section 2.40.10 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

F. The Engineer reserves the right to sample and test any shipment and to reject any material not meeting the requirements of the specifications.

Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the North Carolina Department of Transportation for all asphalt paving work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Transportation of Bituminous Mixture: Asphalt Mixtures shall be hauled in accordance with Section 6.9 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

Deliver paint and pavement-marking materials to Project site in original containers and packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

C. Store paint and pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Apply asphalt materials only when the environmental conditions for the specific material to be applied are in accordance with Section 9 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces in environmental conditions recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. All aggregates utilized in bituminous pavement mixtures shall be in accordance with Section 2.5 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section with the exception of paragraph 2.5.2.D.

2.2 ASPHALT MATERIALS

A. All asphalt materials utilized on the project shall be in accordance with the requirements of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. Water: Potable.

2.3 PAVEMENT MARKINGS

A. The following are minimum requirements and shall govern except all local, state and/or federal highway or transportation department standard specifications shall govern when their requirements are in excess thereof.

B. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type F, and colors complying with the latest revision of FS TT-P-1952.

1. Color: As indicated.

2.4 WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete, 2,500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

PRE-FORMED TRAFFIC-CALMING DEVICES

Speed Bumps, Humps, and Cushions: Solid, integrally colored, 100 percent postconsumer or commingled postconsumer and postindustrial recycled **plastic**; UV stabilized. Provide holes for anchoring to substrate.

Size: Modular bumps 2 inches high by 10 inches wide by 72 inches long, with overall length as dimensioned on Drawings.

2. Size: Modular assemblies 4 inches high by 14 feet in overall width, with overall length as dimensioned on Drawings.

Mounting Hardware: Galvanized-steel hardware as standard with device manufacturer.
Adhesive: As recommended by device manufacturer.

2.6 COMPOSITION OF MIXTURES

The asphalt mix formula shall be in accordance with Section 4.6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. The job mix formula for each mixture will establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to the aggregate, and a single temperature at which the mixture is to be discharged from the plant and shall be within the design limits specified for the particular type of bituminous mixture.

C. The job mix formula for each mixture shall be in effect until modified in writing by the Engineer.

D. All mixtures furnished for the work shall conform to the job mix formula within the tolerance ranges specified for the particular mix involved as specified herein.

E. Should a change in sources of aggregate materials be made, a new job mix formula will be required before the new mixture is produced.

F. When unsatisfactory results or other conditions make it necessary, the Engineer may establish a new job mix formula.

G. Bituminous Base Course, Type B 25.0B: The bituminous base course mixture shall conform to Table 2 in Section 4.6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

H. Bituminous Intermediate Course, Type I 19.0B: The bituminous intermediate course mixture shall conform to Table 2 in Section 4.6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

I. Bituminous Surface Course (SF 9.5A and S 9.5B): The bituminous surface course mixture shall conform to Table 2 in Section 4.6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

J. Tack Coat: Tack Coat shall conform to Section 9.31 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction System.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.

Proof roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons.

3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation asphalt.

3.2 COLD MILLING

A. The equipment utilized in milling of existing asphalt pavements shall be in accordance with Section 8.7 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction System.

B. Additional equipment necessary to satisfactorily remove the pavement in the area of manholes, water valves, curb and gutter, and other obstructions shall be provided.

C. The pavement removal operations shall be conducted to effectively minimize the amount of dust being emitted in accordance with local, State, and Federal air pollution control laws and regulations. The operation shall be planned and conducted so that it is safe for persons and property adjacent to the work including the traveling public.

Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

E. The existing pavement shall be milled in a manner which will restore the pavement surface to a uniform longitudinal profile and cross section at the locations and in accordance with typical sections shown on the plans. Where indicated in the plans, removal shall be to a specified depth and shall produce a specified cross slope.

F. The Contractor may elect to make multiple cuts to achieve the required depth of cut or cross slope required by the plans.

G. The longitudinal profile of the milled surface shall be established by a mobile string line on the side of the cut nearest the centerline of the road. The cross slope of the milled surface shall be established by an automatic cross slope control mechanism or by a second skid sensing device located on the outside edge of the cut. The Engineer may waive the requirement for automatic grade and cross slope controls where conditions warrant.

H. The milling equipment shall be operated in such a manner as to prevent damage to the underlying pavement structure, utilities, drainage facilities, curb and gutter, paved surfaces outside the milled area, and any other appurtenances. The milled pavement surface shall be reasonably smooth and free of excessive scarification marks or other damage as determined by the Engineer. Any leveling or patching required as a result of negligence by the Contractor shall be repaired with hot bituminous plant mix at no cost to the Owner and in a manner acceptable to the Engineer. The Contractor shall coordinate the adjustment of manholes, meter boxes and valves boxes with the milling operation.

I. The Engineer may require remilling any area where surface laminations or defects resulting from the Contractor's operations cause a non-uniform surface to occur.

J. The milled pavement surface shall be thoroughly cleaned of all loose aggregate particles, dust and other objectionable material by the use of power brooms, power blowers, power vacuums or other means.

3.3 PATCHING

Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. The surface preparation necessary for asphalt patching shall be done in accordance with Section 3.5 below.

Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

D. Tack Coat: Tack coat shall be applied in accordance with Section 9.3 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

E. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

F. Traffic Markings: The Contractor shall repair and restripe any traffic markings that were damaged, removed or covered during construction. All work shall be done in accordance with the requirements described elsewhere in this section.

G. Existing Utilities: All existing manhole and valve covers shall be raised by the Contractor as necessary prior to paving so that the tops of the covers are flush with the final surface. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

3.4 REPAIRS

Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.5 SURFACE PREPARATION

A. Preparation of Subgrade: The work covered under this section of this specification shall be performed in strict accordance with Section 500 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures.

B. Application of Aggregate Base Course: The work covered under this section of this specification shall be performed in strict accordance with Section 520 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures.

C. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

Mix herbicide with prime coat if formulated by manufacturer for that purpose.

Prime Coat: Prime coat shall be applied in accordance with Section 9.2 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

F. Tack Coat: The work covered under this section of this specification shall be performed in strict accordance with Section 605 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures and Section 9.3 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

3.6 HOT-MIX ASPHALT PLACING

A. Asphalt Mixtures shall be hauled in accordance with Section 6.9 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System.

B. Bituminous Plant Mix - General: The work covered under this section of this specification shall be performed in strict accordance with Section 610 and Section 620 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures and Sections 2 through 6 and Section 9 of the Superpave Hot Mix Asphalt / Quality Management System of the North Carolina Department of Transportation Pavement Construction Section. For pavement repairs, see Section 654 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures.

Base Course, Type B 25.0B); Intermediate Course (I 19.0B); Surface Courses (SF 9.5A and S 9.5B): All hot mix placement and compaction operations shall conform to Section 9.4 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

D. Spreading and Finishing: Spreading and finishing of asphalt pavements shall be done in accordance with Section 9.5 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

E. Compaction: Compaction of asphalt pavements shall be done in accordance with Section 9.7 of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

F. Joints:

1. Transverse Joints: Transverse joints are to be constructed in accordance with Section 9.9 of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

2. Longitudinal Joints: Longitudinal are to be constructed in accordance with Section 9.10 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

G. Weather and Seasonal Limitations: Placement of asphalt is limited in accordance with Section 9.4.3 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

3.7 ASPHALT CURBS

Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 degrees F.

Asphalt Mix: Same as pavement surface-course mix.

B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.8 ASPHALT TRAFFIC-CALMING DEVICES

Construct hot-mix asphalt speed bumps, humps, cushions, and tables over compacted pavement surfaces. Apply a tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 degrees F.

1. Tack Coat Application: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

Asphalt Mix: Same as pavement surface-course mix.
Before installation, mill pavement that will be in contact with bottom of traffic-calming device. Mill to a depth of 1 inch from top of pavement to a clean, rough profile.

B. Place hot-mix asphalt to cross section indicated, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.9 PAVEMENT MARKING

Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.

Paint shall only be applied when the atmospheric, surface, and material conditions are in accordance with the manufacturer’s requirements.

C. Contractor must insure that pavement surface to be painted shall be clean and dry before application. All surface contamination such as oil, grease, dirt, foreign matter, or other deleterious materials will be removed by the Contractor prior to application of paint.

Paint shall be applied with mechanical equipment to produce uniform straight edges in strict compliance with the manufacturer's instructions. Paint shall be applied in two (2) coats at the manufacturer's recommended rates.

WHEEL STOPS

Install wheel stops in bed of adhesive as recommended by manufacturer.

B. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.11 PRE-FORMED TRAFFIC-CALMING DEVICES

Install pre-formed speed bumps, humps, and/or cushions in bed of adhesive as recommended by manufacturer for heavy traffic.

B. Securely attach preformed speed bumps, humps, and/or cushions to pavement with hardware spaced as recommended by manufacturer for heavy traffic. Recess head of hardware beneath top surface.

3.12 FIELD QUALITY CONTROL

A. The Owner will engage a qualified testing agency to perform tests and inspections and shall bear the responsibility for paying all costs associated with passing tests. The Contractor shall bear all costs in making all necessary repairs to make work satisfactory after a failed test and shall pay all costs associated with failed tests.

B. Sampling and testing shall be in accordance with Section 7 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

C. Mat cross-slope and thickness shall be tested according to Section 10.1.8 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

D. Surface texture shall conform to Section 10.1.9 of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section. Smoothness shall conform to Section 10.2. Areas found to reveal non-conformance corrected by the Contractor by removal of the defective work and replacement with new material unless other corrective measures are permitted by the Engineer. The work and materials required in the correction of defective work shall be provided by the Contractor at no cost.

E. The Contractor shall repaint and restripe any traffic markings that were damaged, removed or covered during construction. All work shall be done in accordance with NCDOT requirements and specifications. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

All existing manhole and valve covers shall be raised by the Contractor as necessary prior to paving so that the tops of the covers are flush with the final surface. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

Replace and compact hot-mix asphalt where core tests were taken.

H. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 DISPOSAL

Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. The milled material shall become the property of the Contractor. All milled material shall be disposed of by the Contractor in an EPA-approved landfill, except where the milled material is used in the work or recycled. Do not allow milled materials to accumulate on-site.

END OF SECTION 321216

SECTION 321313 CONCRETE PAVING

GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Driveways.
2. Roadways.
3. Parking lots.
4. Curbs and gutters.
5. Walks.

B. Related Sections:

Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.

2. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

1.3 DEFINITIONS

Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

Product Data: For each type of product indicated.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Other Action Submittals:

1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

Material Test Reports: For each of the following:

1. Aggregates.
2. Portland Cement: The Contractor shall submit a copy of mill test reports on all cement delivered to the job 7 days prior to use of the cement.
3. Fly Ash: Complete chemical and physical analysis of each carload of fly ash shall be submitted to the Engineer ten (10) days prior to use of each carload delivered.

F. Submit records of all concrete pours showing exact location of pour, date of pour, quantity of pour, and class of concrete poured to the Engineer each month. Temperature at time of pour should also be recorded.

1.5 QUALITY ASSURANCE

A. All Portland cement concrete paving shall be in accordance with the appropriate sections of the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Division 7 and associated referenced sections, standards and drawings.

B. If the average strength of the laboratory control cylinders shows the concrete to be below the specified design strength, the aggregate proportions and water content may be changed by the Engineer, who, in addition to such changes, may require core tests. Tests confirming concrete strengths on hardened concrete which was poured without testing shall be paid for by the Contractor.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for public and emergency uses, as well as other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-5.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

Steel reinforcement utilized in all concrete paving shall be in accordance with the appropriate paragraphs of the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1070.

2.3 CONCRETE MATERIALS

A. Cementitious Material: All cementitious materials utilized in the Work shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition). All cementitious materials, shall be of same type, brand, and source throughout Project:

1. Portland Cement: shall be fresh stock of an approved standard brand meeting the requirements of ASTM C 150, white portland cement Type II meeting the requirements of the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1024-1.
2. Fly Ash: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1024-5.
3. Ground Granulated Blast-Furnace Slag: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1024-6.
4. Coarse Aggregate: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1014-2.
5. Fine Aggregate: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1014-1.

B. Water: shall be potable and in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1024-4.

C. Air-Entraining Admixture: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1024-3.

D. Chemical Admixtures: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1024-3.

2.4 CURING MATERIALS

A. All curing agents for concrete paving shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1026.

2.5 RELATED MATERIALS

A. Joint Materials: shall be appropriately selected in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1028.

B. Adhesive and Epoxy Bonding Agents: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1081.

2.6 PAVEMENT MARKINGS

A. Pavement-Markings: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1087.

2.7 PAVEMENT MARKERS

A. Pavement-Markers: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1086.

2.8 WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete, 2,500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide

chamfered corners, drainage slots on underside, and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.9 PRE-FORMED TRAFFIC-CALMING DEVICES

Speed Bumps, Humps, and Cushions: Solid, integrally colored, 100 percent postconsumer or commingled postconsumer and postindustrial recycled plastic; UV stabilized. Provide holes for anchoring to substrate.

Size: Modular bumps 2 inches high by 10 inches wide by 72 inches long, with overall length as dimensioned on Drawings.

2. Size: Modular assemblies 4 inches high by 14 feet in overall width, with overall length as dimensioned on Drawings.
3. Mounting Hardware: Galvanized-steel hardware as standard with device manufacturer.

Adhesive: As recommended by device manufacturer.

2.10 CONCRETE MIXTURE

A. The concrete mix design utilized for all concrete paving shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1000-3.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding. Proof-rolling shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Sections 260-1 through 260-3.

C. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Division 31 Section "Earth Moving."

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. Before placing concrete, all equipment for mixing and transporting and placing concrete shall be cleaned, all debris and ice removed from spaces to be occupied by the concrete, forms thoroughly cleaned of soil, ice, or other coatings which will prevent proper bond, reinforcement shall be securely tied in place and expansion joint material, anchors, and other embedded items shall be securely positioned. Hardened concrete and foreign materials shall be removed from the conveying equipment.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Form Installation, Use and Removal: shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-5.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

General: Comply with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Sections 425-1 through 425-5 for fabricating, placing, and supporting reinforcement.

3.5 JOINTS

General: Joint construction shall comply with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-11.

B. Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.

3. Provide tie bars at sides of paving strips where indicated.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

Locate expansion joints at intervals of 50 feet unless otherwise indicated.

2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 INSPECTION

A. Before placing concrete, the formwork installation and reinforcing steel must be complete. Notify Engineer upon completion of installation of all forms and reinforcing in ample time to permit inspection of the work. Subbase is subject to testing as directed by the Engineer. Place concrete immediately after approval of subbase, formwork and reinforcement.

3.7 CONCRETE PLACEMENT

Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

B. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Place concrete in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-5.

D. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practical by methods which will prevent separation or loss of ingredients and in a manner which will assure that the required quality concrete is obtained. Conveying equipment shall be of size and design to insure a continuous flow of concrete at the delivery end.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Batch tickets for each load of concrete shall be submitted to the Engineer. The following information shall be provided on each batch ticket:

1. Design mix designation.
2. Exact time cement, water and aggregate were discharged into the mix.
3. Compressive strength of mix.
4. Amount of water added to the mix.

G. Concrete shall be deposited and spread in a continuous operation such that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be located at points as provided for in the drawings or as approved. Placing shall be carried on at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Deposit concrete as nearly as possible to its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure which will cause segregation. Do not push or drag concrete into place or use vibrators to move concrete into place.

H. Maintain equipment in proper operating condition, with drums cleaned before charging of each batch. Schedule delivery of trucks in order to prevent delay of placing after mixing.

I. Concrete shall not be allowed to "freefall" a distance greater than 3 feet.

J. Do not use concrete which has become non-plastic and unworkable or does not meet the required quality control limits, or which has become contaminated by foreign material. Remove rejected concrete from the project site and dispose of in an acceptable location.

K. Consolidate concrete in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-6.

L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 degrees F within five (5) days after the concrete is placed, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 55 degrees F and not more than 80 degrees F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
4. Cover top with insulating blankets. Blankets shall remain in place for a minimum period of five days.
5. In addition to laboratory-cured test specimens, additional concrete test specimens shall be cured under the same field conditions that the concrete in the field represented by these cylinders is cured and high thermometers shall be placed on the surface of slab to record daily temperatures during curing period.

M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. An approved admixture designed to retard the rate of set shall be used for all concrete placed when temperatures exceed 75 degrees F. Set retarding admixtures shall conform to ASTM C-494, Type D, water reducing and retarding.
2. Provide wind breaks around the perimeter of the area where concrete is being placed.
3. Cool ingredients before mixing to maintain concrete temperature below 90 degrees F at time of placement. Fresh concrete with temperatures 90 degrees F. or above shall be discarded off site. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water.
4. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

Fog-spray forms**,** steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.8 CONCRETE FINISHING

A. Finish concrete surfaces in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 710-6.

3.9 JOINT SEALING

A. General: Joint sealing shall be performed in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-12.

3.10 DETECTABLE WARNINGS

Blockouts: Form blockouts in concrete for installation of approved detectable paving units.

1. Tolerance for Opening Size: Plus 1/4 inch, no minus.

B. Stamped Detectable Warnings: Install approved stamped detectable warnings as part of a continuous concrete paving placement and according to stamp-mat manufacturer's written instructions.

1. Before using stamp mats, verify that the vent holes are unobstructed.
2. Apply liquid release agent to the concrete surface and the stamp mat.
3. Stamping: While initially finished concrete is plastic, accurately align and place stamp mats in sequence. Uniformly load, gently vibrate, and press mats into concrete to produce imprint pattern on concrete surface. Load and tamp mats directly perpendicular to the stamp-mat surface to prevent distortion in shape of domes. Press and tamp until mortar begins to come through all of the vent holes. Gently remove stamp mats.
4. Trimming: After 24 hours, cut off the tips of mortar formed by the vent holes.

Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

3.11 CONCRETE PROTECTION AND CURING

A. Concrete Protection: shall comply with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-8.

B. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures, and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.

C. Concrete Curing: shall comply with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-9.

D. Curing for concrete paving surfaces during periods when the outside air temperature does not exceed 60 degrees F. shall be provided by applying a membrane-forming curing compound to concrete surfaces as soon as the final troweling or floating operation has been completed. Application shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-9. Do not use membrane curing compounds on surfaces which are to be covered with a coating

material applied directly to the concrete or with any other cover or finish material which shall be bonded to the concrete.

E. Curing for all pavement surfaces during periods when the outside air temperature will exceed 60 degrees F. shall be provided by covering the entire surface with burlap. Application shall be in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-9. Immediately following the placement of the burlap, the entire surface shall be maintained continuously wet for a period of 7 days. Do not permit surfaces to dry at any period during the required curing period.

F. During the curing period, protect concrete from damaging mechanical disturbances, including load stresses, shocks, excessive vibration and from change caused by subsequent construction operations.

3.12 PAVING TOLERANCES

A. Tolerances for pavement thickness shall comply with the appropriate portions of the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Sections 700-15 and 710-9.

B. Tolerances for surface smoothness shall comply with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 710-7.

3.13 PAVEMENT MARKINGS

The application of pavement markings shall comply with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1205.

B. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.

C. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.

Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

3.14 PAVEMENT MARKERS

The installation of pavement markers shall comply with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 1250.

B. Do not install pavement-markers until layout, colors, and placement have been verified with Engineer.

C. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.

3.15 WHEEL STOPS

Install wheel stops in bed of adhesive applied as recommended by manufacturer.

B. Securely attach wheel stops to paving with not less than two galvanized steel dowels located at one-quarter to one-third points. Install dowels in drilled holes in the paving and bond dowels to wheel stop. Recess head of dowel beneath top of wheel stop.

3.16 PREFORMED TRAFFIC-CALMING DEVICES

Install preformed speed bumps, humps, and/or cushions in bed of adhesive applied as recommended by manufacturer for heavy traffic.

B. Securely attach preformed speed bumps, humps, and/or cushions to paving with hardware spaced as recommended by manufacturer for heavy traffic. Recess head of hardware beneath top surface.

3.17 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections as required.

3.18 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Engineer. Make edges of cuts perpendicular to the concrete surfaces.

B. Repair and patch defective areas immediately after removal of forms as directed by the Engineer. Dampen all concrete surfaces in contact with patching concrete, and brush with a neat cement grout coating or concrete bonding agent. Place

patching concrete before grout takes its initial set. Mix patching concrete of the same materials to provide concrete of the same type or class as the original adjacent concrete. Place, compact, and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

C. Drill test cores where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with approved non-shrink grout compatible with the pavement concrete.

D. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

E. Protect concrete paving from environmental factors in accordance with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Section 700-8.

F. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

3.19 TESTING AND QUALITY CONTROL

A. The Owner shall employ a concrete testing laboratory to provide all laboratory testing services on the project and a concrete technician to perform all quality control tests on concrete and materials used to batch concrete. The testing agency employed shall meet the requirement of "Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction", (ASTM E-329).

B. Such tests will be provided and paid for by the Owner, except that tests which reveal non-conformance with the Specifications and all succeeding tests for the same area, until conformance with the Specifications is established shall be at the expense of the Contractor. The Owner will be responsible for paying for only the successful tests.

C. The Contractor shall provide and maintain adequate facilities on the project for the testing laboratory to locate the required testing equipment and for safe storage area for test cylinders. The general contractor shall provide at his own expense all casual labor needed to assist the concrete technician in obtaining samples of concrete and concrete materials and moving and transporting cylinders and materials which are being tested.

D. Acceptance testing for concrete pavement shall comply with the North Carolina Department of Transportation Standard Specifications for Road and Structures (latest edition) Sections 700-15.

END OF SECTION 321313

SECTION 322905 RESTORATION OF SURFACES

GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section covers the furnishing of all labor, equipment and materials necessary for the proper restoration of existing surfaces disturbed or damaged as a result of construction operations which are not specifically scheduled or specified for topsoil and seeding, paving, landscaping or other surfacing.

B. In general, the types of replacement included in this section are seeding along pipelines, concrete sidewalks, driveways, roadways, ditches, lawns and landscaped areas, and curb and gutter.

C. Any damage to existing structures shall be repaired using materials and workmanship equal to, or better than, those of the original construction.

1.3 DEFINITIONS

A. CABC – Crushed aggregate base course.

B. NCDOT – North Carolina Department of Transportation.

C. PSI – Pounds per square inch.

1.4 SUBMITTALS

A. All submittals shall be in accordance with the requirements of the pertinent specification sections referenced herein.

B. An appropriate concrete mix design shall be submitted for all concrete sidewalks, driveways, roadways, and curb and gutter restored as part of this project.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SEEDING DISTURBED AREAS

A. All ground surfaces disturbed by construction activity, which are not classified as lawns, landscaped areas, or pavement areas, but would be classified as open fields, shall be raked smooth and seeded in accordance with the appropriate paragraph(s) within Section 329200 entitled Turf and Grasses. Large rocks, clumps of earth and excessive spoil material shall be removed from the area prior to seeding.

B. Shoulders of all roads shall be restored as specified for lawns and landscaped areas.

C. Wooded areas not classified as lawns shall be restored to as near their original condition as possible.

3.2 CONCRETE SIDEWALKS

A. Concrete walks removed in connection with, or damaged as a result of, construction operations under the Contract shall be replaced with new construction. Such walks shall be constructed of 4,000 PSI concrete on a thoroughly compacted subgrade, shall have a vertical thickness, unless otherwise noted, of not less than 4 inches or the thickness of the replaced walk where greater than 4 inches.

B. Walks shall be float finished, edged with an edging tool, and grooved at intermediate intervals not in excess of the width of the walk, uniform throughout the length of the walk in any one direction.

3.3 DRIVEWAYS

A. Unless otherwise noted, unpaved driveways shall be surfaced with not less than 4 inches of CABC, topped with 4 inches of stone, gravel, or other materials equal to that found in the original driveway. Driveways shall be left in a condition better than their original condition.

B. Concrete drives shall be replaced with 4,000 PSI concrete and shall have equal thickness and reinforcing steel to that of the original drive. Prior to placing the concrete a 6-inch aggregate base course shall be placed in the drive area.

C. Unless otherwise noted, bituminous or asphaltic concrete drives shall be restored to original base and asphalt thicknesses or a minimum of 6 inches of aggregate

base course and a 2-inch surface course, whichever is greater. Base material shall be compacted in 3-inch lifts and Type SF 9.5A or S 9.5B asphalt compacted in 2-inch lifts to match existing pavement section. All work shall be in accordance with the appropriate paragraph(s) of Section 321216 entitled Bituminous Paving.

3.4 ROADWAY REPLACEMENT

A. Bituminous or Asphaltic pavements shall include all areas paved with blacktop, built up pavements or oil and stone, tar and stone and similar pavements constructed with a bituminous or asphalt and stone materials.

B. Immediately upon completion of installation of underground piping and structures, the trench shall be backfilled and the roadway shall be repaired. Provide materials as specified in the Contract Drawings. If, in the opinion of the Engineer, the area adjacent to the excavation has not been damaged to the extent that the base course need to be replaced, restoration may consist of a surface course of sufficient thickness to meet the existing pavement.

C. Unless otherwise noted, bituminous or asphaltic concrete roadways shall be restored to original base and asphalt thicknesses or a minimum of 6 inches of aggregate base course and a 2-inch surface course, whichever is greater. Base material shall be compacted in 3-inch lifts and Type SF 9.5A or S 9.5B asphalt compacted in 2-inch lifts to match existing pavement section. All work shall be in accordance with the appropriate paragraph(s) of Section 321216 entitled Bituminous Paving.

D. Portland cement concrete roadways shall be replaced with 4,000 PSI concrete and shall have equal thickness and reinforcing steel as the original roadway. An aggregate base course with a thickness of 6 inches shall be placed prior to the placing of concrete.

E. Differential settlement of restored pavements shall be corrected immediately.

F. The Contractor shall repair and restripe any traffic markings that were damaged, removed or covered during construction. All work shall be done in accordance with NCDOT requirements and specifications.

G. All existing manhole and valve covers shall be raised, as required, by the Contractor prior to paving. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

3.5 DITCHES

A. Ditches shall be regraded to the original grade and line. The surface of all ditches shall be returned to the same condition as found before commencing work.

3.6 LAWNS AND LANDSCAPED AREAS

A. Lawns and landscaped areas shall be regraded and replaced as follows:

1. Grading shall be to the grade existing before construction of the work under this Contract.
2. Lawn replacement shall be in accordance with the appropriate paragraph(s) within Section 329200 entitled Turf and Grasses. Topsoiled areas shall be replaced with topsoil of equal quality and quantity.

B. Landscaped areas shall be replaced with shrubs, hedges, ornamental trees, flowers, or other items to original condition.

3.7 CURB AND GUTTER

A. Curb and gutter removed with or damaged as a result of construction operations, injured or disturbed by the Contractor, his agents, or employees, shall be replaced with new construction to a condition similar and equal to that existing before damage was incurred. 4,000 PSI concrete shall be used in curb and gutter replacement.

B. All work associated with curb and gutter replacement shall be in accordance with Section 846-3 of the NCDOT Standard Specifications for Roads and Structures (latest edition). Horizontal and vertical alignment of the curb and gutter shall match that of the existing to the greatest extent practical, unless directed otherwise by the Engineer.

3.8 DAMAGE TO STRUCTURES

A. Any damage to existing structures shall be repaired of materials and workmanship equal to those of original construction. Extensively damaged structures, where the structural stability has been affected or which cannot be repaired in a suitable fashion shall be replaced entirely. Replacement shall not commence until approval of the plan of replacement has been given by the Engineer. Replacement costs shall be responsibility of the Contractor.

END OF SECTION 322905

SECTION 329200 TURF AND GRASSES

GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section covers the furnishing of all labor, equipment and materials necessary for the establishment of vegetation in all areas of the site disturbed by construction operations and all earth surfaces of embankments including rough and fine grading, topsoil if required, fertilizer, lime, seeding and mulching. The Contractor must adapt operations to variations in weather or soil conditions as necessary for the successful establishment and growth of the grasses or legumes.

1.3 DEFINITIONS

Duff Layer: The surface layer of native topsoil composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, molluscicides are substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms occur where they are not desired or cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Soil present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

SUBMITTALS

A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

Evidence of State certification of each seed mixture for turfgrass sod and plugs. Include identification of nursery source and name and telephone number of supplier.

Product Certificates: For soil amendments and fertilizers, from manufacturer.

C. Certificates of Inspection as required by law or governing authorities to accompany shipments.

D. Source of mulch for approval and five (5) gallon bucketful physical sample.

E. Proposed planting schedule, indicating dates for all work during normal seasons for such work. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.

Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf and grasses during a calendar year. Submit before expiration of required initial maintenance periods.

1.5 QUALITY ASSURANCE

A. No material substitutions will be permitted without the prior written approval of the Engineer.

B. All materials must be applied in strict accordance with manufacturer’s written instructions.

1.6 DELIVERY, STORAGE, AND HANDLING

Products must be packed and shipped in a manner which will not damage them.

B. Damaged products must be rejected upon delivery and promptly removed from the site.

C. Products which must be stored prior to installation must be protected from damage and theft.

D. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable. During handling and storing, the seed must be cared for so it is protected from damage by heat, moisture, rodents, or other causes.

E. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.7 PROJECT CONDITIONS

Schedule and coordinate work with all trades involved.

B. Verify the areas of work have been properly contoured and brought to final grade prior to beginning work.

C. Consult record drawings and installers to determine actual underground utility and drainage system locations in the vicinity of work. Damage to known or unrecorded utilities must be repaired at the Contractor's expense.

D. Notify the Engineer of any unforeseen conditions which will affect plant installation or growth.

E. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

Optimum Spring Planting: April 1 – May 1.

2. Optimum Fall Planting: September 1 – October 1.

F. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.8 MAINTENANCE SERVICE

Initial Turf Maintenance Service: Provide full maintenance by skilled employees. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until Final Acceptance of the project by the Owner.

Initial Meadow Maintenance Service: Provide full maintenance by skilled employees. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until Final Acceptance of the project by the Owner.

Continuing Maintenance Requirements: Throughout the warranty period of the Work, excluding conditions of vandalism, theft, accident, acts of God and Owner's negligent maintenance, Contractor this responsible for making any and all necessary repairs to planted areas which may include or may result from, the lack of fully established growth of turfs and grasses and/or soil erosion from project areas. In such instances, Contractor is responsible for restoring these areas to originally accepted conditions as well as full establishment of turfs and grasses or other groundcovers in the area. The Contractor is also responsible for any damages to adjacent areas impacted by the lack of proper turf and grass establishment.

PART 2 - PRODUCTS

2.1 FERTILIZERS

A. The quality of fertilizer and all operations in connection with the furnishing of this material must comply with the requirements of the North Carolina Fertilizer Law and regulations adopted by the North Carolina Board of Agriculture.

B. For all areas to be seeded, which are not classified as lawns, but are classified as open fields, fertilizer must be free-flowing, ready mixed 10-10-10 grade commercial fertilizer. Upon written approval of the Engineer a different grade of fertilizer may be used, provided the rate of application is adjusted to provide the same amounts of plant food.

C. For all areas to be seeded which are classified as lawns, fertilizer is as follows:

1. Fertilizer tablets: Agriform Planting Tablets 20-10-5 as manufactured by Scotts-Sierra Horticultural Products, or equal, may be used at installer's option.
2. Encapsulated fertilizer: Osmocote 19-6-12 as manufactured by Scotts-Miracle Gro, or equal, may be used at installer's option.

D. During handling and storing, the fertilizer must be cared for in such a manner to protect against hardening, caking, or loss of plant food values. Any hardened or caked fertilizer must be pulverized to its original conditions before being used.

2.2 LIME

A. Lime: The quality of lime and all operations in connection with the furnishing of this material must comply with the requirements of ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
2. Provide lime in the form of free-flowing ground dolomitic limestone.

B. During the handling and storing, the lime must be cared for in such a manner to protect against hardening and caking. Any hardened or caked lime must be pulverized to its original condition before being used.

2.3 SEED

Grass seed must be fresh, clean, dry, new-crop seed complying with the requirements of the North Carolina Seed Law and regulations adopted by the North Carolina Board of Agriculture.

B. Seed must be approved by the North Carolina Department of Agriculture or any agency approved by the Engineer before being sown, and no seed will be accepted with a date of test more than nine (9) months prior to the date of sowing. However, testing does not relieve the Contractor from responsibility for furnishing and sowing seed that meets these specifications at the time of sowing. When a low percentage of germination causes the quality of the seed to fall below the minimum pure live seed specified, the Contractor may elect, subject to the approval of the Engineer, to increase the rate of seeding sufficiently to obtain the minimum pure live seed contents specified, provided that such an increase in seeding does not cause the quantity of noxious weed seed per square yard to exceed the quantity that would be allowable at the regular rate of seed.

C. During handling and storing, the seed must be cared for it is protected from damage by heat, moisture, rodents, or other causes.

D. Seed must be entirely free from bulblets or seed of Johnson Grass, Nutgrass, Sandbur, Wild Onion, Wild Garlic, and Bermuda Grass. The specifications for restricted noxious weed seed refers to the number per pound, singly or collectively, of Blessed Thistle, Wild Radish, Canada Thistle, Corncockle, Field Bindweed, Quackgrass, Dodders, Dock, Horsenettle, Bracted Plantain, Buckhorn or Wild Mustard; but in no case shall the number of Blessed Thistle or Wild Radish exceed 27 seeds of each per pound. No tolerance on weed seed is allowed.

E. Seed Purity: All seed species must consist of seed with not less than a 95 percent germination rate, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

2.4 MULCH

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, threshed straw of wheat, rye, or oats which is free of noxious weeds or other species which would grow and be detrimental to the specified grass.

B. Wood Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 10 percent (±2 percent); organic matter 99.4 percent (±0.2 percent); ash content 0.6 percent (±0.2 percent) water holding capacity of 1050 grams water/100 grams dry fiber. and a pH range of 4.5 to 6.5.

2.5 TACKIFIER

Tackifier must consist of an asphalt emulsion in accordance with ASTM D 977, Grade SS-1; shall be nontoxic and free of plant-growth or germination inhibitors.

2.6 WATER

Water must be clean, clear water free from any objectionable or harmful chemical qualities or organisms and shall be furnished by the Contractor.

2.7 EROSION-CONTROL MATERIALS

Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

B. Erosion-Control Mats: Cellular, non-biodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface. Include manufacturer's recommended anchorage system for slope conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

1. Verify no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable and too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Engineer and replace with new planting soil.

3.2 PROTECTION OF EXISTING STRUCTURES, UTILITIES, TREES AND VEGETATION

A. Protect existing structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, and smothering of trees by stockpiling construction materials or excavated materials, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide wood or metal stakes 48 inches in height, set on eight (8) to 10 foot centers, connected by 2-inch minimum brightly colored flagging tape or fabric fencing to protect trees and vegetation to remain. Set perimeter of protection at the drip line of trees to remain unless approved otherwise by the Engineer.

B. Provide protection for roots over 1-1/2 inch in diameter cut during construction operations. Coat cut faces with an emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out and cover with earth as soon as possible.

C. The Contractor cannot remove or damage trees and shrubs which are outside the Clearing Limits established by the Owner or those within the Clearing Limits designated to remain.

D. Repair trees scheduled to remain and damaged by construction operations in a manner acceptable to the Engineer. Repair damaged trees promptly to prevent progressive deterioration caused by damage.

E. Replace trees scheduled to remain and damaged beyond repair by construction operations, as determined by the Engineer, with trees of similar size and species.

Repair and replacement of trees scheduled to remain and damaged by construction operations or lack of adequate protection during construction operations shall be at the Contractor's expense.

F. Protect adjacent and adjoining areas from hydroseeding, hydromulching, and tackifier overspray.

G. Protect grade stakes set by others until directed to remove them.

3.3 GRADING

A. Rough grading must be done as soon as all excavation required in the area has been backfilled. The necessary earthwork must be accomplished to bring the existing ground to the desired finish elevations as shown on the Contract Drawings or otherwise directed.

B. Fine grading must consist of shaping the final contours for drainage and removing all large rock, clumps of earth, roots and waste construction materials, including loosening soil to a depth of 6” by plowing, discing, harrowing or other approved methods until the area is acceptable as suitable for subsequent landscaping operations. The work of landscaping must be performed on a section by section basis immediately upon completion of earthwork.

C. Upon failure or neglect on the part of the Contractor to coordinate grading with seeding and mulching operations and diligently pursue the control of erosion and siltation, the Engineer may suspend the Contractor's grading operations until as the work is coordinated in a manner acceptable to the Engineer.

3.4 SECURING AND PLACING TOPSOIL

A. Topsoil must be secured from areas from which topsoil has not been previously removed, either by erosion or mechanical methods. Topsoil must be removed to a depth in excess of the depth approved by the Engineer.

B. The area or areas from which topsoil is secured shall possess such uniformity of soil depth, color, texture, drainage and other characteristics as to offer assurance that, when removed the product, will be homogeneous in nature and conform to the requirements of these specifications.

C. All areas from which topsoil is to be secured, must be cleaned of all sticks, boards, stones, lime, cement, ashes, cinders, slag, concrete, bitumen or its residue and any other effuse which could hinder or prevent growth.

D. In securing topsoil from a designated pit, or elsewhere, should strata or seams of material occur, which do not come under the requirements for topsoil, it must be

removed from the topsoil or if required by the Engineer, the pit must be abandoned.

E. Before placing or depositing topsoil upon any areas, all improvement within the area must be completed, unless otherwise approved by the Engineer. The areas in which topsoil is to be placed or incorporated must be prepared before securing topsoil· for use.

F. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.5 SEEDBED PREPARATION

A. The Contractor must cut and satisfactorily dispose of weeds or other unacceptable growth on the areas to be seeded. Uneven and rough areas outside of the graded section, such as crop rows, farm contours, ditches and ditch spoil banks, fence line and hedgerow soil accumulations, and other minor irregularities which cannot be obliterated by normal seedbed preparation operations, must be shaped and smoothed as directed by the Engineer to provide for more effective seeding and for ease of subsequent mowing operations.

B. The soil must then be scarified or otherwise loosened to a depth of not less than 6 inches except as otherwise provided below or otherwise directed by the Engineer. Clods must be broken and the top 2 to 3 inches of soil must be worked into an acceptable seedbed by the use of soil pulverizers, drags, or harrows; or by other methods approved by the Engineer.

C. On 2:1 slopes a seedbed preparation are required to be the same depth as required on flatter areas, although the degree of smoothness may be reduced from that required on the flatter areas if so permitted by the Engineer.

D. On cut slopes steeper than 2:1, both the depth of preparation and the degree of smoothness of the seedbed may be reduced as permitted by the Engineer, but in all cases the slope surface must be scarified, grooved, trenched, or punctured so as to provide pockets, ridges, or trenches in which the seeding materials can lodge.

E. On cut slopes either 2:1 or steeper, the Engineer may permit the preparation of a partial or complete seedbed during the grading of the slope. If at the time of seeding and mulching operations such preparation is still in a condition acceptable to the Engineer, additional seedbed preparation may be reduced or eliminated.

F. The preparation of seedbeds cannot be done when the soil is frozen, extremely wet, or when the Engineer determines it is in an otherwise unfavorable working condition.

G. Limestone may be applied at the rate described below as a part of the seedbed preparation, provided it is immediately worked into the soil. If not, limestone and fertilizer must be applied as described below.

3.6 APPLICATION OF LIMESTONE, FERTILIZER, SEED, AND MULCH (GENERAL)

A. Equipment to be used for the application, covering or compaction of limestone, fertilizer, and seed must be approved by the Engineer before being used on the project. Approval may be revoked at any time if equipment is not maintained in satisfactory working condition, or if the equipment operation damages the seed.

B. Limestone, fertilizer, seed and mulch must be applied within 24 hours after completion of seedbed preparation unless otherwise permitted by the Engineer. However, no limestone or fertilizer be distributed and no seed sown if the Engineer determines can weather and soil conditions are unfavorable.

3.7 FERTILIZATION AND LIMING

A. Following seedbed preparation, fertilizer must be applied to all areas to be seeded to achieve the application rates shown below. Fertilizer must be spread evenly over the seedbed and be lightly harrowed, raked, or otherwise incorporated into the soil for a depth of ½ inch.

B. Fertilizer need not be incorporated in the soil as specified above when mixed with seed in water and applied with power sprayer equipment. The seed cannot remain in water containing fertilizer for more than 30 minutes when a hydraulic seeder is used.

C. Agricultural limestone must be thoroughly mixed into the soil according to the rates indicated below. The specified rate of limestone application may be reduced by the Engineer if pH tests indicate this to be desirable. The Contractor is responsible for obtaining such tests and submitting the results to the Engineer for adjustment in rates.

D. In the absence of a soil test, the following rates of application of fertilizer and lime must be to all areas to be seeded which are not classified as lawns, but would be classified as open fields:

1. Lime: 4,000 pounds per acre
2. Fertilizer: 1,000 pounds per acre

E. For all areas to be seeded, which are classified as lawns, fertilizer and lime must be applied at the following rates:

1. Lime: 92 pounds per 1,000 square feet

2. Fertilizer: 23 pounds per 1,000 square feet

F. When adverse seeding conditions are encountered due to steepness of slope, height of slope, or soil conditions, the Engineer may direct or permit modifications be made in the above requirements which pertain to incorporating limestone into the seedbed; covering limestone, seed, and fertilizer; and compacting the seedbed. Modifications may include, but are not limited to, the following:

1. The incorporation of limestone into the seedbed may be omitted:

a. on cut slopes steeper than 2:1;
b. on 2:1 cut slopes when a seedbed has been prepared during the excavation of the cut and is still in an acceptable condition; or
c. on areas of slopes where the surface of the area is too rocky to permit the incorporation of the limestone.

G. The Contractor is responsible for making an additional application of maintenance fertilizer in the amount of 650 pounds per acre (15 pounds per 1,000 square feet) following the initial establishment of groundcover. This application must occur when vegetation is three (3) inches in height or 45 days after initial seeding, whichever comes first.

3.8 SEEDING

A. Seeding must commence as soon as preparation of the seedbed has been completed. Do not broadcast or drop seed when wind velocity exceeds 5 mph or until the surface is suitable for working and is in proper condition. Seed mixtures may be sown together provided they are kept in a thoroughly mixed condition during the seeding operation.

B. All disturbed areas must be seeded unless specifically indicated to receive other types of plantings or groundcovers.

C. Seed may be uniformly sown over the seedbed by a mechanical method suitable for the slopes and size of the areas to be seeded. Broadcast type seeders, windmill hand seeder or approved mechanical power drawn seed drills may be utilized.

1. Do not use wet seed or seed that is moldy or otherwise damaged.
2. Do not seed against existing trees.

D. For all areas to be seeded which are not classified as lawns, but are classified as open fields. Seed species and application rates are as follows:

1. Spring/Summer (Normally April 1 to August 31):

a. 100 pounds of Ky-31 tall fescue per acre.

2. Fall and Winter (Normally September 1 to March 31):

    a. 85 pounds of Ky-31 tall fescue and 15 pounds of rye grain per acre.

3. On cut and fill slopes having 2:1 or steeper slopes, add 15 pounds of sudangrass to the planned seeding in summer seeding or 25 pounds of rye cereal per acre in fall and winter seeding, if seeded September to February.
4. These seeding rates are prescribed for all sites with less than 50 percent ground cover and for sites with more than 50 percent ground cover where complete seeding is necessary to establish effective erosion control vegetative cover. On sites having 50 to 80 percent ground cover where complete seeding is not necessary to establish vegetative cover, reduce the seeding rate at least one-half the normal rate.

E. For all areas to be seeded which are classified as lawns, seed species and application rates shall be as follows:

    1. "Rebel" turftype fescue.....3 pounds per 1,000 square feet
    2. "Falcon" turftype fescue .....3 pounds per 1,000 square feet

    Total Mix .....6 pounds per 1,000 square feet

F. Care must be taken to adjust the seeder for seeding at the proper rate before seeding operations are started and to maintain their adjustment during seeding. Seed in hoppers must be agitated to prevent segregation of the various seeds in the mixture.

G. Immediately after application, harrow, drag, rake, or otherwise work seedbed to cover the seed with a layer of soil. The depth of covering must be as directed by the Engineer. If two kinds of seed are to be used which require different depths of covering, they must be sown separately.

H. When a combination seed and fertilizer drill is used, fertilizer may be drilled in with the seed after limestone has been applied and worked into the soil. If two kinds of seed are being used which require different depths of cover, the seed requiring the lighter cover may be sown broadcast or with a special attachment to the drill, or drilled lightly following the initial drilling operation.

    1. The rates of application of limestone, fertilizer, and seed on slopes 2:1 or steeper or on rocky surfaces may be reduced or eliminated.
    2. Compaction after seeding may be reduced or eliminated on slopes 2:1 or steeper, on rocky surfaces, or on other areas where soil conditions would make compaction undesirable.

I. Protect seeded areas with erosion-control mats where shown on Drawings; install and anchor according to manufacturer's written instructions.

3.9 MULCHING

A. All seeded areas must be uniformly mulched in a continuous blanket immediately after seeding. The mulch must be applied so as to permit some sunlight to penetrate and the air to circulate and at the same time, shade the grounds, reduce erosion and conserve soil moisture. Approximately 25 percent of the ground must be visible through the mulch blanket.

B. To achieve the coverage described above, it is necessary to apply straw mulch to seeded areas at a rate of approximately 4,000 pounds per acre (92 pounds per 1,000 square feet) or wood fiber mulch at a rate of 1,600 pounds per acre (37 pounds per 1,000 square feet).

C. Mulch must be uniformly spread by hand or by approved mechanical spreaders or blowers which will provide an acceptable application as described above.

D. Before mulch is applied on cut or fill slopes which are 3:1 or flatter, and ditch slopes, the Contractor must remove and dispose of all exposed stones in excess of 3 inches in diameter and all roots or other debris which will prevent proper contact of the mulch with the soil.

E. Care must be exercised to prevent displacement of soil or seed or other damage to the seeded area during the mulching operations.

F. The Contractor must take sufficient precautions to prevent mulch from entering drainage structures through displacement by wind, water, or other causes and shall promptly remove any blockage to drainage facilities which may occur.

3.10 TACKIFIER

A. Emulsified asphalt or organic tackifier must be sprayed uniformly on mulch as it is ejected from blower or immediately thereafter. Tackifier must be applied evenly over area creating uniform appearance. Application rates and method of application will vary with conditions, be approved by the Engineer, and applied in sufficient amount to assure that the mulch is properly held in place. Where the binding material is not applied directly with the mulch it must be applied immediately following the mulch operation.

B. The Contractor must cover/protect structures, poles, fences and other appurtenances if mulch binder is applied in such a way that it may come in contact with or discolor those structures or appurtenances. Mulch and binder must be applied by suitable blowing equipment at closely controlled application rates in a manner acceptable to the Engineer.

C. Asphalt cannot be used in freezing weather.

3.11 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseeding applications. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with fiber-mulch tackifier in accordance with manufacturer's recommendations.
2. Fiber mulch must be mixed into the slurry such that the application rate of the fiber mulch is 1,500 to 2,000 pounds per acre.
3. Apply slurry uniformly to all areas to be seeded in a one-step process in accordance with the application rates described.

B. When a hydraulic seeder is used for application of seed and fertilizer, the seed cannot remain in water containing fertilizer for more than 30 minutes prior to application unless otherwise permitted by the Engineer.

3.12 EROSION CONTROL MATERIALS

Install all erosion control materials according to manufacturer’s recommendations and as shown on Drawings.

3.13 TURF RENOVATION

Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

C. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

D. Mow, dethatch, core aerate, and rake existing turf.

E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

H. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.

I. Apply seed and protect with straw mulch as required for new turf.

J. Water newly planted areas and keep moist until new turf is established.

3.14 TURF MAINTENANCE

A. The Contractor must keep all seeded areas in good condition, reseeding and mowing if and when necessary as directed by the Engineer, until a good lawn is established over the entire area seeded and maintain these areas in an approved condition until final acceptance of the Contract.

B. Grassed areas will be accepted when a 95 percent cover by permanent grasses is obtained and weeds are not dominant. On slopes, the Contractor must provide against washouts by an approved method. Any washouts which occur must be regraded and reseeded until a good sod is established.

C. Areas of damage or failure due to any cause must be corrected by repair or by being completely redone as may be directed by the Engineer. Areas of damage or failure resulting either from negligence on the part of the Contractor in performing subsequent construction operations or from not taking adequate precautions to control erosion and siltation as required throughout the various sections of the specifications must be repaired by the Contractor as directed by the Engineer at no cost to the Owner.

3.15 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 329200

SECTION 330500 COMMON WORK RESULTS FOR UTILITIES

GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

Piping joining materials.

2. Transition fittings.
3. Sleeves.
4. Identification devices.
5. Grout.
6. Flowable fill.
7. Piped utility demolition.
8. Piping system common requirements.
9. Equipment installation common requirements.
10. Painting.
11. Concrete bases.
12. Metal supports and anchorages.

1.3 DEFINITIONS

Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

C. ABS: Acrylonitrile-butadiene-styrene plastic.

D. CPVC: Chlorinated polyvinyl chloride plastic.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Dielectric fittings.
2. Identification devices.

1.5 QUALITY ASSURANCE

Steel Support Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. As required, coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other Division 33 Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches for ducts, and 3/4 inch for access door signs and similar operational instructions.

1. Material: Brass.
2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.

Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.

G. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

H. Lettering: Manufacturer's standard preprinted captions as selected by Engineer.

Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

K. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

Material: 0.032-inch thick, polished brass or aluminum.

2. Material: 0.0375-inch thick stainless steel.
3. Material: 3/32-inch thick plastic laminate with 2 black surfaces and a white inner layer.
4. Material: Valve manufacturer's standard solid plastic.
5. Size: 1-1/2 inches in diameter, unless otherwise indicated.

Shape: As indicated for each piping system.

L. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
3. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

N. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible. Include the following:

    a. Name and plan number.
    b. Equipment service.
    c. Design capacity.

d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.

1. Size: 3-1/4 by 5-5/8 inches.
2. Fasteners: Brass grommets and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.

Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

2.2 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.3 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.

1. Cement: ASTM C 150, Type I, portland.
2. Density: 115- to 145-lb/cu. ft.
3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.

Aggregates: ASTM C 33, natural sand, fine.

6. Admixture: ASTM C 618, fly-ash mineral.
6. Water: Comply with ASTM C 94.
7. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

Refer to Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

3.3 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.4 PAINTING

Painting of piped utility systems, equipment, and components is specified in Division 09 painting Sections.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.

Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
Locate pipe markers on exposed piping according to the following:

a. Near each valve and control device.
b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
d. At manholes and similar access points that permit view of concealed piping.
e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.6 CONCRETE BASES

Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "[**Cast-in-Place Concrete**] [**Miscellaneous Cast-in-Place Concrete**]"

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 330500

SECTION 332660 WATER PIPE AND APPURTENANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Where specific standards are referenced within this document, the most current specification and/or latest revision shall apply.

1.2 SUMMARY

A. Section includes:

1. Pipe and fittings.
2. Valves and appurtenances.
3. Fire hydrants.
4. Manhole sections and appurtenances.
5. Transition couplings

1.3 SCOPE OF WORK

A. Furnish all labor, equipment, materials and incidentals necessary to install and complete installation of potable water lines and appurtenances in accordance with the plans. All pipe and appurtenance material shall be of the type and class specified herein.

B. All pipeline and appurtenance excavation, bedding, pipe laying, jointing and coupling of pipe joints and backfilling shall be completed as described herein.

1.4 DEFINITIONS

A. ANSI – American National Standards Institute

B. API – American Petroleum Institute

C. ASTM – American Society for Testing and Materials

D. AWWA – American Water Works Association

E. DIP – Ductile Iron Pipe

F. HDD – Horizontal Directional Drilling

G. HDPE – High Density Polyethylene

H. LB – Pound

I. MSS – Manufacturer's Standardization Society

J. NFPA – National Fire Protection Association

K. NSF – National Sanitation Foundation

L. PE – Polyethylene

M. PPM – Parts Per Million

N. PSI – Pounds per Square Inch

O. PVC – Polyvinyl Chloride

1.5 SUBMITTALS

A. All submittals shall be in accordance with the requirements of Division 1 of these specifications.

B. Shop drawings or submittals shall be required for the following:

1. All sizes and types of pipe.

2. All pipe fittings, valves, hydrants, and appurtenances.

3. All manholes and vaults

4. All transition couplings.

5. Wiring Diagrams: Power, signal, and control wiring for alarms.

C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Operation and Maintenance Data: For specialties valves and appurtenances to include in emergency, operation, and maintenance manuals.

1.6 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall coordinate material deliveries with the manufacturer/supplier. All materials shall be handled and stored in accordance with the manufacturer's recommendations using methods that will prevent damage to the materials.

B. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.

2. Protect valves against damage to threaded ends and flange faces.

3. Set valves in best position for handling. Set valves closed to prevent rattling.

4. Protect pipe from vehicle exhaust by covering pipe materials with tarps.

C. The Contractor shall unload pipe so as to avoid deformation or other injury thereto. Pipe shall not be placed within pipe of a large size and shall not be rolled or dragged over gravel or rock during handling. If any defective material is discovered after installation, it shall be removed and replaced with sound pipe or shall be repaired by the Contractor in an approved manner and at his own expense.

D. The Contractor shall store all pipe and appurtenances on sills above storm drainage level and deliver for laying after the trench is excavated. Do not store any plastic materials in direct sunlight. All plastic materials shall be supported to prevent sagging and bending. All plastic materials shall also be covered with tarps if exposed to the elements for extended periods of time.

E. Protect pipe, pipe fittings, and seals from dirt and damage.

F. Handle all materials in accordance with the manufacturer's written instructions.

G. When any material is damaged during transporting, unloading, handling or storing, the undamaged portions may be used as needed, or, if damaged sufficiently, the Engineer will reject the material as being unfit for installation.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following

conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Engineer and utility Owner no fewer than 72 hours in advance of proposed interruption of service.

2. Do not proceed with interruption of water-distribution service without utility Owner's written permission.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with all requirements of utility Owner supplying water including the tapping of water mains and backflow prevention.

2. Comply with all standards of authorities having jurisdiction for potable water service piping, including materials, installation, testing, and disinfection.

3. Comply with standards of authorities having jurisdiction for fire suppression water service piping, including materials, hose threads, installation, and testing.

B. All piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

E. NSF Compliance:

1. As applicable, comply with NSF 14 for plastic potable-water-service piping, including marking "NSF-pw" on piping.

2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.9 COORDINATION

A. Coordinate any connections to the existing water distribution system with utility Owner.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

A. All materials shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs, and other imperfections, and true to theoretical shapes and forms throughout. All materials shall be subject to the inspection of the Engineer at the plant, trench, or other point of delivery, for the purpose of culling and rejecting material which does not conform to the requirements of these specifications. Such material shall be marked by the Engineer, and the Contractor shall remove it from the project site upon notice being received of its rejection.

B. As particular specifications are cited, the designation shall be construed to refer to the latest revision under the same specification number, or to superseding specifications under a new number, except provisions in revised specifications which are clearly inapplicable.

2.2 DUCTILE-IRON PIPE (DIP)

A. Ductile Iron Pipe shall be manufactured in accordance with AWWA C151. All Ductile Iron Pipe shall be Class 350 unless otherwise specified and shall be lined with a cement mortar lining not less than 1/16” thick conforming to AWWA C104. Pipe wall thickness for all Ductile Iron Pipe shall conform to “Thickness Design for Ductile Iron Pipe,” AWWA C150. The standard laying condition shall be type 2 according to AWWA C150/C151 unless specified otherwise. The exterior of all Ductile Iron Pipe shall have a protective coating of a coal tar or asphaltic material a minimum of 1 mil thickness conforming to AWWA C151. Ductile Iron Pipe larger than 12” in diameter that are to be field cut shall be gauged full length. Flanged Ductile Iron Pipe and any Ductile Iron Pipe that is to be coated in the field shall have a shop applied primer compatible with the field installed coating system.

B. Slip-Joint Ductile Iron Pipe:

1. Bells of “slip” joint pipe shall be contoured to receive a bulb-shaped circular rubber gasket, and plain ends shall have a slight taper to facilitate installation. The gasket and associated lubricant shall be furnished by the pipe manufacturer and shall be manufactured in accordance with ANSI Specification A21.11.

2. The jointing shall be done by guiding the plain end into the bell until contact is made with the gasket and by exerting a sufficient compressive force to drive the joint home until plain end makes full contact with the base of the bell. No joint may exceed a maximum deflection of 11 inches in an 18-foot joint of pipe (3 degrees).

C. Mechanical-Joint Ductile Iron Pipe:

1. All mechanical joint pipe shall be manufactured in accordance with AWWA C111. Pipe shall be manufactured in accordance with AWWA C151, and the pipe thickness shall be Class 350 as determined by AWWA C150 unless otherwise noted.

2. All bolts shall be tightened by means of torque wrenches in such a manner that the follower shall be brought up toward the pipe evenly. If effective sealing is not obtained by tightening the bolts to the specified torques, the joint shall be disassembled and reassembled after thorough cleaning.

3. Bolts for mechanical joints shall be high grade steel, low alloy type, with tee or hex head and American Standard threads. Mechanical joint gland shall be gray iron and shall utilize a plain rubber gasket.

D. Flanged-Joint Ductile Iron Pipe:

1. Flanged pipe shall be factory assembled by threading plain end pipe, screwing on the flange(s) and machine tightening.

2. Where required, flanges shall be tapped for stud bolts. Flanges shall be accurately faced at right angles to the pipe axis and shall be drilled smooth and true, and covered with coal tar pipe varnish or otherwise protected against corrosion of flange faces. Flange faces shall be cleaned to bare metal with wire brushed before installation of pipe.

3. Ductile iron flanged joint pipe shall have a thickness of Class 53 minimum and shall conform to AWWA C110 and AWWA C115. All pipe shall have Class 125 flanges conforming to AWWA C110 unless otherwise specified.

4. Flanged joints shall be made up with through bolts of the required size. Bolts in exposed locations shall be zinc plated. Bolts in submerged locations shall be stainless steel. All bolts shall have good and sound, well-fitting threads, so that the nuts may be turned freely by hand.

5. Flanged joints shall be made up using only full face gaskets with a minimum thickness of 1/8-inch. Ring gaskets are not acceptable. Gasket material shall be rubber or approved equal as recommended by the Manufacturer.

6. Connecting flanges shall be in proper alignment and no external force shall be used to bring them together.

7. Field installed flanges shall be EBAA Series 1000 E-Z flange or equal for all instances where normal operating pressures are less than 200 psi. Restraint set screws must be tightened by use of a torque wrench per the manufacturer’s instructions.

E. Restrained Push-on Joint Ductile Iron Pipe

1. Restrained joints shall be manufactured in accordance with ANSI/AWWA C111/A21.11.

2. Restrained push joints (positive locking segments) shall be American “Flex-Ring,” or “Lok-Ring”; Clow “Super-Lock”; U.S. Pipe “TR Flex”; or pre-approved equal. Use of setscrews bearing on the pipe wall will not be acceptable.

3. Restrained push joints (gaskets with stainless steel gripping segments) shall be U.S. Pipe “Field Lok 350 Gasket,” or American “Fast Grip” or pre-approved equal

4. Restrained push joints (locking wedge type) shall be EBAA Iron “Megalug” Series 1700, Tyton “TR Flex Gripper Ring,” or American “Field Flex Ring,” or pre-approved equal.

F. Restrained Mechanical Joint Ductile Iron Pipe

1. Restrained mechanical joints shall be manufactured in accordance with ANSI/AWWA C111/A21.11.

2. Restrained mechanical joints (factory prepared spigot) shall be American “MJ coupled Joints,” or U.S. Pipe “Bolt-Lok” or “Mech-Lok” Or pre-approved equal

3. Restrained mechanical joints (field cut spigot) shall be manufactured in accordance with AWWA C151 and shall be EBAA Iron “Megalug” Series 1100, Star Pipe Products “StarGrip”, or pre-approved equal.

2.3 POLYVINYL CHLORIDE PIPE (PVC)

A. All materials shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs, and other imperfections, and true to theoretical shapes and forms throughout. All materials shall be subject to the inspection of the Engineer at the plant, trench, or other point of delivery, for the purpose of culling and rejecting material which does not conform to the requirements of these specifications. Such material shall be marked by the Engineer, and the Contractor shall remove it from the project site upon notice being received of its rejection.

B. As specific specifications are cited, the designation shall be construed to refer to the latest revision under the same specification number, or to superseding specifications under a new number, except provisions in revised specifications which are clearly inapplicable.

C. PVC pipe 4 inches in diameter and larger shall be manufactured in accordance with AWWA C900 and shall have a minimum dimension ratio (DR) of 18 unless specified otherwise. All Pressure Rated PVC Pipe 3 inches diameter and smaller shall be manufactured in accordance with ASTM D2241 and have a standard dimension ratio (SDR) of 13.5 unless otherwise specified. The exterior of all PVC Pipe shall bear a stamp which shows the AWWA certification, SDR, size and NSF seal.

1. All PVC pipes 4-inches and larger in diameter shall have slip or "push-on" joints which are manufactured in accordance with AWWA C900. All PVC pipes 3-inches and smaller in diameter shall have slip or "push-on" joints which are manufactured in accordance with AWWA C151. All pipes shall have a bell with integral rubber gasket.

2. Bells of "slip" joint pipe shall be contoured to receive a bulb shaped circular rubber gasket, and plain ends shall have a slight taper to facilitate installation. The lubricant used in making up the joints shall be furnished by the pipe manufacturer and shall be NSF approved. The jointing shall be done by guiding the plain end into the bell until contact is made with the gasket and by exerting a sufficient compressive force to drive the joint home until the assembly mark on the pipe barrel is flush with the end of the bell. No joint may exceed a maximum deflection of 11 inches in an 18-foot joint of pipe (3 degrees).

2.4 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

A. High-density polyethylene pipe may be used in the horizontal directional drilling of water distribution piping as indicated on the project drawings. Piping shall be extruded from a polyethylene compound and shall conform to the following requirements:

1. The polyethylene resin shall meet or exceed the requirements of ASTM D3350 for PE 3408 material with a cell classification of 335434C or better.

2. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by precompounding in a concentration not less than 2 percent.

3. The maximum allowable hoop stress shall be 800 PSI at 73.4 degrees Fahrenheit.

4. The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe in this project.

5. The pipe and bends shall have a minimum standard dimension ratio (SDR) wall thickness as specified by the Engineer.

6. Joining shall be performed by thermal butt-fusion in accordance with the manufacturer's recommendations.

2.5 FITTINGS

A. All fittings for any type of water piping shall be ductile iron mechanical joint type in accordance with AWWA C153 (ductile iron, compact type) for 3 inch through 24 inch diameter fittings and AWWA C110 (ductile iron, full body type) for pipe diameters larger than 24 inches. Where flanged pipe is used ductile iron fittings shall be flanged in accordance with AWWA C153 or C110 where applicable for exposed piping. All flanges shall be Class 125 unless otherwise noted.

B. All fittings shall be lined with cement mortar not less than 1/16-inch thick in conformance with AWWA C104 and suitable for a minimum of 250 PSI working pressure unless otherwise specified.

C. All mechanical joints shall be manufactured in accordance with AWWA C111. The Contractor shall provide suitable 3-inch plugs with stainless steel threaded nipples and sleeves for connection of fittings for PVC pipe 2 inches in diameter and smaller.

D. Restraint devices for mechanical joint pipe for nominal pipe sizes 3-inch through 48-inch shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10. The devices shall have a working pressure rating of 350 psi for 3 through 16-inch and 250 psi for 18 through 48-inch. Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes.

2.6 GASKETS

A. All rubber gaskets for DIP and PVC pipe and fittings shall be in accordance with AWWA C111. All gaskets shall be a product of the pipe manufacturer, made specifically for the pipe being installed, and shall match the shape and configuration of the joint.

2.7 WATER SERVICE PIPE AND APPURTENANCES

A. All water service piping shall be constructed of Type "K" flexible copper tubing in accordance with ASTM B 88 or SDR 9 HDPE as described above.

B. All fittings utilized for copper tubing shall be pressure-seal (compression-type) fittings.

C. Corporation stops shall be constructed of brass.

D. Meter boxes shall be of round style and made of Polyvinyl Chloride Plastic with a minimum wall thickness of 0.375 inches. Meter box shall be sized to accept a 5/8-inch water meter and shall have a minimum inside diameter of 18 inches with a 30-inch depth. Meter box shall have a non-locking cast iron lid.

E. The inlet and outlet pipes that pass through the box wall shall be brass and shall be locked in place with brass hex nuts on straight external pipe threads. The inlet and outlet of these nipples shall have external tapered pipe threads and shall be protected by Polyethylene Cap Plugs. An In-Line quarter turn shut off valve with internal tapered pipe thread inlet and water meter coupling outlet shall be used upstream of the water meter. The valves shall be soft seating with a padlock wing. The valves internal components shall be removable from the top of the valve body. An In-Line Dual Check Valve with independent acting checks shall be used downstream of the water meter. The check valve shall have a meter coupling inlet and shall be contained inside the box. The internal parts of the check valve shall be removable without disconnecting the check valve the outlet piping. All brass materials used in contact with the water shall have a minimum copper content of 80 percent and a maximum zinc content of 10 percent.

2.8 GATE VALVES

A. All gate valves shall be designed for a minimum working pressure of 250 PSI unless otherwise specified. Valves shall have a clear waterway equal to the full nominal diameter of the pipe. Valves shall be opened by turning counterclockwise. Each valve shall have the initials or name of the maker, pressure rating and year of manufacture cast on the body. Prior to shipment from the factory, each valve shall be tested by hydraulic pressure equal to twice the specified working pressure. Valves shall be operated by handwheel for above ground installations or 2-inch square operating nut for below ground installations. Valves shall have an arrow cast in the metal indicating the direction of opening.

B. All valves to be installed underground (buried) shall be of the non-rising stem type and shall have mechanical joint connections.

C. All valves installed above ground or in structures shall have rising stems with outside stem and yoke and 18-inch diameter minimum hand wheel and shall have flanged ends with Class 125 flanges unless others noted.

D. Valves 1-1/2-inches and Smaller:

1. Valves 1-1/2 inches and smaller in diameter shall be full port, quarter turn ball valves suitable for underground installation.

2. Valves shall have a forged brass body, adjustable packing, and threaded ends conforming to NPT standards.

3. Valves shall be manufactured in accordance with MSS-SP-110.

E. Resilient Seated Wedge Valves:

1. Gate valves 2 inches through 16 inches in diameter size shall be of ductile iron body, resilient seated wedge type meeting the requirements set forth in AWWA C-509. All valves shall be from one manufacturer and parts interchangeable.

2. Gate valves shall have body, bonnet and gate manufactured of ductile iron conforming to ASTM A-536. The shell thickness of all components shall conform to the thicknesses in Table 2, Section 4.4 of AWWA C-509. The valve body and bonnet shall be coated on both the interior and exterior surfaces with a fusion bonded epoxy paint conforming to AWWA C-550.

3. The gate shall be fully covered with a rubber cover over all exterior and interior ferrous surfaces. The rubber shall be securely bonded to the gate body, including the part which houses the stem nut. The gate and rubber coat shall conform to ASTM D429.

4. Valve stems shall be cast bronze or copper alloy. The stuffing box shall use “O”-ring seal type with two rings located above the thrust collar. The rings shall be replaceable with the valve fully open and under pressure.

5. Valves larger than 12 inches in diameter shall be designed for horizontal installation with beveled gear boxes with reduction gears to reduce the number of turns required to operate valve.

2.9 BUTTERFLY VALVES (20” and Larger Valves)

A. Valve shall be designed, manufactured, and tested in accordance with AWWA C504, latest revision, and include the following design features. Valve shall be rated and tested for absolute, zero leakage shut-off.

B. Valve body shall be ductile iron per ASTM A536 Grade 65-45-12. Flanged end valves shall be faced and drilled per ANSI B16.1, Class 125, or as specified by purchaser. Mechanical joint ends shall be per ANSI A21.11 and include mechanical joint end accessories. Valve body shall include a stainless steel seat ring that is mechanically retained without use of clamping devices, adjusting segments, or other hardware being in the waterway.

C. Valve disc shall be solid type ductile iron without any external vanes, ribs, etc., to obstruct flow. Resilient seat shall be located on edge of disc, offset from the shaft, and seal against mating stainless steel body seat with 360 degree uninterrupted contact. The resilient seal shall be locked to the disc by three separate means of retention, and be field-adjustable, if necessary, with no tools other than a standard socket wrench. Replacement of seat in field shall be possible without valve disassembly. The disc shall be connected to the offset stainless steel shaft by locked taper wedge keys and stainless steel retaining nuts on the back side

of the disc. Taper keys shall be heat treated 416 Stainless Steel for added strength. Shaft shall be stub type for valves 30 inches and larger in diameter; one piece for valves 24 inches in diameter and smaller. The valve shall be equipped with adjustable thruster for centering the disc on valves 30 inches and larger in diameter, if required.

D. Shaft shall have nylon sleeve or woven Teflon fiberglassed backed sleeve for bearing surfaces. Bearings shall be self-lubricating.

E. Valve body shall be primed with manufacturer's standard primer.

F. Butterfly valves shall be manufactured by Val-Matic, DeZurik, Pratt, Mueller, or pre-approved equal.

2.10 VALVE BOXES

A. All valve boxes shall be cast iron and shall conform to ASTM A48 and AWWA M44. Valve boxes shall be of the adjustable screw type (based on depth of burial) with a base to fit the valve yoke with a removable cover with the word "WATER" cast thereon.

2.11 FIRE HYDRANTS

A. Fire hydrants shall comply with all of the applicable requirements of the AWWA C502, latest revision, for dry-barrel fire hydrants and with these specifications. Hydrants shall be of the traffic model type incorporating a break-away flange arrangement which will permit the upper section of the hydrant barrel to separate from the lower section upon impact. Each hydrant shall include an automatic system designed to lubricate the entire length of the threaded part of the valve stem each time the hydrant is operated. It shall be further equipped with “O”-ring seals to insure that threads on the valve stem do not come into contact with water at any time.

B. Hydrants shall open counterclockwise with 4-1/2-inch diameter compression base valve opening against pressure and be capable of withstanding 250 PSI working pressures and 500 PSI hydrostatic test pressures, unless otherwise specified. The pentagonal operating nut shall be 1-1/2 inches from the point to the flat. Hydrants shall be equipped with one (1) 4-1/2-inch or 5-1/4 inch diameter pumper nozzle as selected by Owner and two (2) 2-1/2-inch diameter hose nozzles, all with National Standard Threads per Appendix A of AWWA C502, and chained nozzle caps. Nozzles shall be reverse threaded into the fire hydrant barrel.

C. Unless otherwise indicated on the plans, all hydrants shall have 6-inch diameter mechanical joint bottom connections, 4-1/2-inch diameter valve openings and a bury to the bottom of the ditch plus the main line diameter. All hydrants shall be

painted the manufacturer's standard red unless otherwise specified. Following installation and testing all hydrants shall be painted with two (2) 6-mil coats of epoxy paint.

D. All iron parts within fire hydrants shall be ductile iron.

E. The bury length (distance from ground line to insert of the hydrant inlet) shall be 4'-0" unless ground conditions shown on plans warrant a deeper bury.

F. The hydrant main valve shall be 4-1/2 inches minimum in diameter and shall be of the full compression design, opening against and closing with pressure. The valve seat ring shall thread into a bronze sub-seat, and all gaskets sealing the seat ring shall be a bronze-to-bronze surface.

G. Drain valves shall be all bronze and allow complete draining of all residual water in the hydrant barrel.

H. All bolting and fasteners below ground shall be stainless steel.

I. The operating machine shall utilize two (2) "O"-ring seals between the revolving nut and bronze-sheathed upper section of the valve rod. The top of the rod shall also be fitted with a travel stop nut to limit downward travel of the rod. All-weather grease shall be used to provide permanent lubrication. A thermoplastic thrust washer shall be used to reduce friction in the thrust collar while opening the hydrant.

J. The hydrant inlet shall be mechanical joint. Joint restraint, if specified, shall be accomplished for mechanical joint by use of mechanical joint gripper glands.

2.12 RESTRAINED JOINT FLANGED COUPLING ADAPTERS

A. Restrained flange adapters shall be installed only where specified on the plans or approved in writing by the Engineer. Flange adapters shall be made of ductile iron conforming to ASTM A536 and have flange bolt circles that are compatible with ANSI/AWWA C110/A21.10.

B. Restraint for the flange adapter shall consist of a plurality of individual actuated gripping wedges to maximize restraint capability. Torque limiting actuating screws shall be used to insure proper initial set of gripping wedges.

C. The flange adapter shall be capable of deflection during assembly, or permit lengths of pipe to be field cut, to allow a minimum of 0.6" gap between the end of the pipe and the mating flange without affecting the integrity of the seal.

D. The flange adapter shall have a minimum pressure rating of 290 psi.

2.13 COMBINATION AIR RELIEF/VACUUM VALVES

A. Air relief valves shall be hydro-mechanical devices which will automatically permit the discharge of surge air when filling the pipeline, relieve the vacuum when draining the pipeline and also release to atmosphere small amounts of accumulated air within the water distribution piping system. Once the air purge or vacuum has been exhausted, the valve shall seat tightly to prevent water leakage.

B. All valves shall have cast iron bodies and be manufactured in accordance with AWWA C512. All valve bodies shall be one (1) integral casting or two (2) valve bodies flange bolted together containing an air and vacuum valve and separate pressure valve mechanism.

C. All air relief valves shall be rated for a minimum working pressure of 300 PSI and subjected to a minimum hydrostatic test pressure of 450 PSI unless specified different.

2.14 TAPPING SLEEVES AND VALVES

A. Tapping sleeves shall consist of two piece split ductile iron, jointed by bolts manufactured of high strength cast iron and incorporating a longitudinal compound rubber gasket. The sleeves shall include split end gasket and two piece mechanical joint glands suitable for the class of pipe around which sleeves are to be placed. Glands will be joined by steel bolts and fastened to the bell openings of the sleeves to form totally enclosed rubber water tight seals around the periphery of the pipe and along the longitudinal joints.

B. The sleeves shall have flanged outlets which will accommodate the tapping valves. Valves will be identical to resilient wedge gate valves elsewhere specified with inlet and outlet ends adaptable to the tapping machine and to provide mechanical joint connections to discharge pipes.

2.15 AIR-CUSHIONED SWING CHECK VALVES

A. The valve shall have a heavy duty body shall be constructed of high-strength cast iron conforming to ASTM A126 Class B with integral flanges, faced and drilled per ANSI B16.1 Class 125 and be suitable for horizontal or vertical installation.

B. All check valves shall be manufactured in accordance with the latest revision of AWWA C508.

C. The valve body shall be the full waterway type, designed to provide a net flow area not less than the nominal inlet pipe size when swung open no more than 25 degrees. The body seat ring shall be replaceable and shall be constructed of

stainless steel only. The stainless steel ring shall be mechanically retained by means of roll pins or stainless steel cap screws.

D. The valve disc shall be constructed of cast iron per ASTM A126 Class B and be attached to the disc arm by means of a single center pin permitting 360-degree articulation. The disc shall present a convex surface to the direction of flow to compensate for oscillation.

E. The disc arm shall be ductile iron or steel, suspended from and keyed to an austenitic stainless steel shaft which is completely above the waterway and supported at each end by heavy bronze bushings. The shaft shall rotate freely without the need for external lubrication. The shaft shall be sealed where it passes through the body by means of a stuffing box and adjustable packing. Simple O-ring shaft seals are not acceptable. Hinge shafts shall be constructed of 316 stainless steel

F. The valve shall be supplied with an outside lever and adjustable counterweight to initiate valve closure. Final closure shall be dampened by means of a single, side-mounted bronze air-cushion assembly directly mounted to the valve body on machined pads. The amount of cushioning shall be easily adjustable without the need for pre-charged air chambers. Commercial air cylinders, which pivot and/or are attached with fabricated brackets, are not acceptable.

G. The valve shall be GA Industries, Inc. Figure 250-DS, equivalent Ross Valve or approval equal.

2.16 ALTITUDE CONTROL VALVES

A. Altitude control valves shall be hydraulically operated, pilot actuated diaphragm type globe or angle valve designed for ground level control of water in an elevated storage tank and reservoirs. The valve operates on a differential in pressure between the height of the water in the reservoir and an adjustable spring loaded pilot control. The valve is to be non-throttling and will remain in the full open position until the shut-off point is reached.

B. The valve shall be constructed with a cast iron body (ASTM A126) with stainless steel stem or shaft and spring, bronze seat (ring) and upper stem bushing, nylon reinforced diaphragms, bronze valve control pilots with stainless steel and Buna-N internal parts. It shall be designed for an internal working pressure of 175 PSI and maximum differential pressure across the diaphragm of basic valve and pilots is not to exceed 300 PSI.

C. The installation shall be designed for either one-way flow or two-way flow as indicated on the Contract drawings.

1. One-way flow: The valve will be used where pressure on the inlet side of the valve is greater than the pressure created by the maximum reservoir or

tank head. The valve's sole function is to fill an elevated tank or reservoir to a desired level.

2. Two-way flow: The valve will be used when pressure on the inlet side is variable. When inlet pressure falls below reservoir pressure the valve opens, allowing reverse falls below reservoir pressure the valve opens, allowing reverse flow from the reservoir and thus maintaining fluid pressure within the water distribution system.

3. The altitude control valve(s) shall be of the size and type indicated on the Contract drawings and as manufactured by GA Industries, Ross Valve or approved equal.

2.17 PRESSURE-REDUCING VALVES

A. Construction: Pressure Reducing Valves larger than 2-inches in diameter shall consist of a main valve assembly and a pilot system, completely assembled tested as unit and ready for field installation.

1. Main valve body shall be globe style, constructed of high-strength cast iron conforming to ASTM A126 Class B with integral flanges, faced and drilled per ANSI B16.1 Class 125. The valve shall be "full-ported" with a flow area through the valve no less than the area of its nominal pipe size and have an integral bottom pad or feet to permit support directly beneath the body.

2. The main valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area and the area on the upper surface is greater than that of the underside. There shall be no diaphragms or springs in the main valve.

3. The valve piston shall be fully guided on its outside diameter and all guiding and sealing surfaces shall be bronze. To minimize the consequences of throttling, throttling shall be by long, stationary vee-ports located downstream of the seat and not by the seat itself. Sawtooth attachments or other add-on devices are not permitted.

4. The valve shall be fully capable of operating in any position without the need of springs and shall not incorporate stems, stem guides or spokes in the waterway. A visual position indicator shall be provided.

5. The main valve shall be serviceable in the line through a single flanged cover which provides easy access to all internal components.

B. Pilot System:

1. Provide a system of pilots and controls to enable the valve to perform the function listed below. All controls and control piping shall be non-corrosive and suitable for the working pressure.

2. System shall include a normally open, direct-acting, diaphragm operated, spring loaded bronze pressure reducing pilot. Pilot shall be easily field-adjustable from near zero to a minimum of 10 percent above the factory setting. Controls shall include adjustable closing speed control, y-strainer and pilot isolating valves.

C. Function: The valve shall function to reduce a higher, fluctuating inlet pressure to a lower, steady outlet pressure regardless of variations in demand.

D. The valve shall be GA Industries Figure 4500-D, Ross Valve equivalent or approved equal.

2.18 MANHOLE SECTIONS AND APPURTENANCES

A. Precast concrete manhole bases, risers and cones shall conform to ASTM C478, latest revision, for precast reinforced concrete manhole sections. Tapered sections and transition sections, where required, shall be of eccentric cone design, having the same wall thickness and reinforcement as the cylindrical ring sections. Flat slab tops shall be required for very shallow manholes and where shown or specified.

B. Minimum compressive strength of concrete shall be 4,000 PSI at 28 days and shall comply with ACI 318, ACI 350. The maximum permissible absorption shall be 6.0%. All cement used in the mixture shall be in accordance with ASTM C 150, Type II. Fine aggregate shall be sand, while coarse aggregate shall be crushed gravel, both in accordance with ASTM C 33. All water utilized in the concrete mix shall be potable water. Bases and risers shall be reinforced with a single cage of steel placed within the center third of the wall. Welded wire fabric shall be in accordance with ASTM A 185. Steel reinforcing bars shall be grade 60 deformed steel in accordance with ASTM A 615. The tongue or the groove of the joint shall contain one (1) line of circumferential reinforcement equal in area to that in the barrel of the manhole riser. The minimum cross-sectional area of steel per linear foot shall be 0.12 square inches. Precast manhole sections shall fit together readily.

C. The quality of materials, the process of manufacture, and the finished manhole sections shall be subject to inspection and approval by the Engineer. The manhole sections shall be perpendicular to their longitudinal axis, within the limits listed in ASTM C478.

D. Manhole Frames and Covers

1. Frames and covers shall be cast iron of superior quality, tough and even texture. Castings shall be gray iron conforming to ASTM A 48, size as indicated, free from blow holes, porosity, hard spots, shrinkage distortion, or other defects, and well cleaned. The bearing surface between frame and cover shall be machined to prevent rocking and rattling.

2. The standard manhole casting shall be designed for heavy duty use with a 190 pound frame and 125 pound cover. All frames and covers shall comply with AASHTO HS20 loading requirements. The minimum opening within the interior of the frame shall be 24-inches. The frame shall have a 4-inch minimum width flange with the cover being 26 inches in diameter and shall include an indented top design with lettering cast into the cover, using the wording "WATER". Acceptable products include John Bouchard & Sons JBS 1155, U.S. Foundry USF 669 ring and KL cover, or an approved equal.

3. Special waterproof manhole frame and covers shall be installed only at those locations indicated on the contract drawings. Watertight rings and lids shall be John Bouchard & Sons JBS 1155, U.S. Foundry 669-KL-BWTL with a 125-pound cover or approved equal. Ring shall have a flat type gasket and cover shall be bolted down with a minimum of four (4) bolts.

4. After the manhole has been set in its final position, set the manhole frame to the required elevation using no more than 12 inches of precast concrete grade rings, or bricks sealing all joints between cone, adjusting rings, and manhole frame. When grade rings or bricks are used, grout with non-shrink grout. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted so as to conform to the exact slope, crown and grade of the existing surrounding pavement. Manhole frames which are placed above final grade will have frames attached to manhole cone section by means of 5/8-inch diameter stainless steel anchors and washers. One anchor bolt shall be provided per hole.

5. When flat slab tops are utilized, frames shall be cast into the top for access into manholes.

E. Brick for manholes and other structures shall conform to applicable requirements of ASTM C62, latest revision, Grade SW.

2.19 TRANSITION COUPLINGS

A. New Water System Construction

1. Transition couplings shall not be permitted in the construction of new water systems, except as necessary when joining dissimilar pipe materials required for horizontal directional drilling or where necessary clearances between water line and sewer or storm drainage piping cannot be achieved.

B. Rehabilitation of Existing Water Systems

1. In general, during the rehabilitation of existing water lines, the use of appropriate transition couplings shall be permitted as approved by the Engineer.

2. When the rehabilitation of an existing water line requires the use of a transition coupling, the use of such couplings shall be as approved by the Engineer. When the nominal diameter of the pipe does not change, an approved transition coupling may be used, as necessary. In these cases, a ductile iron, mechanical joint, solid sleeve shall be used to joint these materials. The solid sleeve shall be as specified above for fittings and shall be the long body-type. The appropriate gaskets shall be selected based on the outside diameter(s) of the material(s) being jointed. All gaskets shall be as specified above. In all cases, the gap between the pipe sections being jointed shall not exceed 0.25 inches.

3. Where the nominal diameter of an existing water line changes as part of a rehabilitation project, an appropriate ductile iron, mechanical joint reducer, as specified above for fittings, shall be used to joint these materials. The appropriate gaskets shall be selected based on the outside diameter(s) of the material(s) being jointed. All gaskets shall be as specified above.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, backfilling and compaction requirements are specified in Division 31 Section "Earth Moving."

3.2 PIPING AND VALVE APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications:

1. Do not use flanged pipe, fittings, or valves or unions for underground (buried) piping. Fittings and valves for underground (buried) piping shall be mechanical joint.

2. Flanged pipe, fittings and valves and unions shall be used on aboveground piping and piping in vaults.

3. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used as specified, unless otherwise indicated.

3.3 PIPING INSTALLATION

A. Existing Utilities and Separation Requirements:

1. The Contractor shall be required to excavate to determine the precise location of utilities or other underground obstructions which are shown on the Plans and/or marked by the utility Owners. Such location and excavation shall be at least 500 feet ahead of construction, unless otherwise noted.

2. All utility Owners shall be notified prior to excavation as required by the 1985 Underground Damage Prevention Act. Utility Owners who are members of OneCall may be notified by calling 811 (toll free) before any excavation or drilling. The Contractor will be fully responsible for damage to any utilities if the Owners have not been properly notified as required by the Underground Damage Prevention Act. All damage to such structures and pipelines and all damage to property or persons resulting from damage to such structures and pipelines shall be borne by the Contractor and shall be completely repaired within a reasonable time. No claim shall be made against the Owner for damage or delay of the work on account of the proximity of, or the leakage from, such structures and pipelines. Where high pressure gas lines are to be crossed, they shall be uncovered by hand excavation methods before other excavation near them is started.

3. Utility Owners may, at their option, have representatives present to supervise excavation in the vicinity of their utilities. The cost of such supervision, if any, shall be borne by the Contractor.

4. Conflicts with underground utilities may necessitate changes in alignment and/or grade of this construction. All such changes will be approved by the Engineer before construction proceeds.

5. When underground obstructions not shown on the Plans are encountered, the Contractor shall promptly report the conflict to the Engineer and shall not proceed with construction until the conflict is resolved.

6. All water lines shall have a minimum 18 inches of vertical separation from storm sewer.

7. Water lines shall be laid at least 10 feet laterally from existing or proposed sanitary sewers, unless local conditions or barriers prevent a 10-foot lateral separation--in which case:

   a. The water line is laid in a separate trench, with the elevation of the bottom of the water line at least 18 inches above the top of the sanitary sewer; or

   b. The water line is laid in the same trench as the sanitary sewer with the water line located at one side on a bench of undisturbed earth, and

with the elevation of the bottom of the water line at least 18 inches above the top of the sanitary sewer.

8. Whenever it is necessary for a water line to cross over a sanitary sewer, the water main shall be laid at such an elevation that the bottom of the water line is at least 24 inches above the top of the sanitary sewer, unless local conditions or barriers prevent an 24 inch vertical separation--in which case both the water line and the sanitary sewer shall be constructed of ferrous materials and with joints that are equivalent to water line standards for a distance of 10 feet on each side of the point of crossing.

9. Whenever it is necessary for a water line to cross under a sanitary sewer, both the water line and the sanitary sewer shall be constructed of ferrous materials and with joints equivalent to water line standards for a distance of 10 feet on each side of the point of crossing. A section of water line pipe shall be centered at the point of crossing.

B. All piping is to be installed in strict accordance with the manufacturer's recommendations, AWWA C600 and AWWA M41 (for ductile iron pipe and appurtenances), AWWA C605 and AWWA M23 (for PVC pipe and appurtenances) and the contract material specifications. Installation manuals from various material suppliers will be furnished to the Engineer for his review and approval prior to installation of any materials. The Engineer may augment any manufacturer's installation recommendations if, in his opinion, it will best serve the interest of the Owner.

C. All piping shall be laid with a minimum of 36 inches of soil cover over the top of the pipe.

D. Proper tools, implements and facilities satisfactory to the Engineer shall be provided and used for the safe and convenient prosecution of pipe laying. All pipe, fittings, valves, and other materials used in the laying of pipe will be lowered into the trench piece by piece by means of suitable equipment in such a manner to prevent damage to the pipe, materials, to the protective coating on the pipe materials, and to provide a safe working condition to all personnel in the trench. Each piece of pipe being lowered into the trench shall be clean and free of defects. It shall be laid on the prepared foundations, as specified elsewhere to produce a straight line on a uniform grade, each pipe being laid so as to form a smooth and straight inside flow line.

E. Pipe shall be removed at any time if broken, injured or displaced in the process of laying same, or of backfilling the trench.

F. When cutting short lengths of pipe, a pipe cutter, as approved by the Engineer, will be used and care will be taken to make the cut at right angles to the center line of the pipe or on the exact skew as shown on the plans. In the case of push-on

pipe, the cut ends shall be tapered with a portable grinder or coarse file to match the manufactured taper.

G. All pipe joints shall be constructed in strict accordance with the pipe manufacturer's specifications and materials and any deviation must have prior approval of the Engineer.

H. The maximum deflection per joint of flexible joint pipe shall be that deflection recommended by the manufacturer. However, at no time will a deflection greater than 3 degrees (11 inches in an 18'-0" pipe section) be allowed.

I. Detectable warning tape and copper tracer wire shall be installed over all piping.

J. Exposed Piping:

1. All exposed piping to be installed inside tanks, wetwells, vaults and buildings shall be installed as shown on the Drawings and field painted as described below. All exposed pipe shall be ductile iron utilizing flanged joints unless otherwise noted.

2. All exposed ductile iron pipe, fittings and valves shall be field painted in accordance with Section 099000. Color of paint shall be as selected by the Owner.

K. Horizontal Directional Drilling of HDPE Water Pipe:

1. The Contractor may install HDPE water piping by means of horizontal directional drilling where shown on the Drawings. The Contractor shall assemble, support, and pretest the pipeline prior to installation in the directional drill tunnel.

2. Horizontal directional drilling shall consist of the drilling of a small diameter pilot hole from one end of the alignment to the other, followed by enlarging the hole diameter for the pipeline insertion. The exact method and techniques for completing the directionally drilled installation will be determined by the Contractor, subject to the requirements of these specifications.

3. The Contractor shall prepare and submit a plan to the Engineer describing the insertion of the HDPE pipe into the opened bore hole. The plan shall include pullback procedure, ballasting, use of rollers, side booms and side rollers, coating protection, internal cleaning, internal gauging, hydrostatic tests, dewatering, and purging.

4. The required piping shall be assembled in a manner that does not obstruct adjacent roadways or public activities. The Contractor shall erect temporary fencing around the entry and exit pipe staging areas.

5. Each length of pipe shall be inspected and cleaned as necessary to be free of debris immediately prior to joining.

6. Pipes shall be joined to one another be means of thermal butt-fusion. Polyethylene pipe lengths to be joined by thermal butt-fusion shall be of the same type, grade, and class of polyethylene compound and supplied from the same raw material supplier.

7. Mechanical connections of the polyethylene pipe to auxiliary equipment shall be through flanged connections which shall consist of the following:

    a. A polyethylene “sub end” shall be thermally butt-fused to the ends of the pipe.

    b. Provide ASTM A240, Type 304 stainless steel backing flange, Class 125, ANSI B16.1 standard, and gaskets as required by the manufacturer.

    c. Stainless steel bolts and nuts of sufficient length to show a minimum of three complete threads when the joint is made and tightened to the manufacturer’s standard. Retorque the nuts after 4 hours.

    d. Butt-fusion of pipes shall be performed in accordance with the manufacturer’s recommendation as to equipment and technique. Butt-fusion jointing shall be 100 percent efficient offering a joint weld strength equal to or greater than the tensile strength of the pipe.

8. Pipe installed by the directional drilled method must be located in plan as shown on the drawings, and must be no shallower than shown on the drawings unless otherwise approved. The Contractor shall plot the actual horizontal and vertical alignment of the pilot bore at intervals not exceeding 30 feet. The “Record Drawing” plan and profile shall be updated as the pilot bore is advanced. The Contractor shall at all times provide and maintain instrumentation that will accurately locate the pilot hole and measure drilling fluid flow and pressure. The Contractor shall grant the Engineer access to all data and readout pertaining to the position of the bore head and the fluid pressure and flows.

9. When requested, the Contractor shall provide explanations of this position monitoring and steering equipment. The Contractor shall employ experienced personnel to operate the directional drilling equipment and, in particular, the position monitoring and steering equipment. No information pertaining to the position or inclination of the pilot hole bores shall be withheld from the Engineer.

10. Each exit point shall be located as shown with an over-length tolerance of 10 feet for directional drills of 1,000 linear feet or less and 40 feet for directional drills of greater than 1,000 linear feet and an alignment tolerance

of 5 feet left/right with due consideration of the position of the other exit points and the required permanent easement. The alignment of each pilot bore must be approved by the Engineer before pipe can be pulled. If the pilot bore fails to conform to the above tolerances, the Engineer may, at his option, require a new pilot boring to be made.

11. After the pipe is in place, cleaning pigs shall be used to remove residual water and debris. After the cleaning operation, the Contractor shall provide and run a sizing pig to check for anomalies in the form of buckles, dents, excessive out-of-roundness, and any other deformations. The sizing pig run shall be considered acceptable if the survey results indicate that there are no sharp anomalies (e.g. dents, buckles, gouges, and internal obstructions) greater than 2 percent of the nominal pipe diameter, or excessive ovality greater than 5 percent of the nominal pipe diameter. For gauging purposes, dent locations are those defined above which occur within a span of 5 feet or less. Pipe ovality shall be measured as the percent difference between the maximum and minimum pipe diameters. For gauging purposes, ovality locations are those defined above which exceed a span of 5 feet.

12. Reaming: Reaming operations shall be conducted to enlarge the pilot bore after acceptance of the pilot bore. The number and size of such reaming operations shall be conducted at the discretion of the Contractor.

13. Pulling Loads: The maximum allowable pull exerted on the HDPE pipelines shall be measured continuously and limited to the maximum allowed by the pipe manufacturer so that the pipe or joints are not over stressed.

14. Torsion and Stresses: A swivel shall be used to connect the pipeline to the drill pipe to prevent torsional stresses from occurring in the pipe.

15. The lead end of the pipe shall be closed during the pullback operation.

16. Pipeline Support: The pipelines shall be adequately supported by rollers and side booms and monitored during installation so as to prevent over stressing or buckling during pullback operation. Such support/rollers shall be spaced at a maximum of 60 feet on centers, and the rollers to be comprised of a non-abrasive material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback. Surface damage shall be repaired by the Contractor before pulling operations resume.

17. The Contractor shall at all times handle the HDPE pipe in a manner that does not over stress the pipe. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50 percent of yield stress for flexural bending of the HDPE pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at

his expense. The Contractor shall take appropriate steps during pullback to ensure that the HDPE pipe will be installed without damage.

18. During drilling, reaming, or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits. To the greatest extent practical, these fluids must not be discharged into the waterway. When the Contractor's provisions for storage of the fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site. The Contractor shall conduct his directional drilling operation in such a manner that drilling fluids are not forced through the subbottom into the waterway. After completion of the directional drilling work, the entry and exit pit locations shall be restored to original conditions. The Contractor shall comply with all permit provisions.

19. Pits constructed at the entry or exit point area shall be so constructed to completely contain the drill fluid and prevent its escape to the beach or waterway.

20. The Contractor shall utilize drilling tools and procedures which will minimize the discharge of any drill fluids. The Contractor shall comply with all mitigation measures listed in the required permits and elsewhere in these specifications.

21. To the extent practical, the Contractor shall maintain a closed loop drilling fluid system.

22. The Contractor shall minimize drilling fluid disposal quantities by utilizing a drilling fluid cleaning system which allows the returned fluids to be reused.

23. As part of the installation plan specified herein before, the Contractor shall submit a drilling fluid plan which details types of drilling fluids, cleaning and recycling equipment, estimated flow rates, and procedures for minimizing drilling fluid escape.

24. All drilling operations shall be performed by supervisors and personnel experienced in horizontal directional drilling. All required support, including drilling tool suppliers, survey systems, mud cleaning, mud disposal, and other required support systems used during this operation shall be provided by the Contractor.

25. A smoothly drilled pilot hole shall follow the design of the pipe profile and alignment described on the construction drawings.

26. The position of the drill string shall be monitored by the Contractor with the downhole survey instruments. Contractor shall compute the position in the X, Y, and Z axis relative to ground surface from downhole survey data a minimum of once per length of each drilling pipe (approximately 31 foot interval). Deviations from the acceptable tolerances described in the

specifications shall be documented and immediately brought to the attention of the Engineer for discussion and/or approval. The profile and alignment defined on the construction drawings for the bore holes define the minimum depth and radius of curvature. The Contractor shall maintain and provide to the Engineer, upon request, the data generated by the downhole survey tools in a form suitable for independent calculation of the pilot hole profile.

27. Between the water's edge and the entry or exit point the Contractor shall provide and use a separate steering system employing a ground survey grid system, such as "TRU-TRACKER" or equal wherever possible. The exit point shall fall within a rectangle 10 wide and 40 feet long centered on the planned exit point.

28. During the entire operation, waste and leftover drilling fluids from the pits and cuttings shall be dewatered and disposed of in accordance with all permits and regulatory agencies requirements. Remaining water shall be cleaned by Contractor to meet permit requirements.

29. Technical criteria for bentonite shall be as given in API Spec. 13A, Specification for Oil Well Drilling Fluids Material for fresh water drilling fluids. Any modification to the basic drilling fluid involving additives must describe the type of material to be used and be included on Contractor's drilling plan presented to the Engineer. The Owner retains the right to sample and monitor the waste drilling mud, cuttings, and water.

30. The horizontal directional drilling operation is to be operated in a manner to eliminate the discharge of water, drilling mud and cuttings to the adjacent creek or land areas involved during the construction process. The Contractor shall provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste. All excavated pits used in the drilling operation shall be lined by Contractor with heavy-duty plastic sheeting with sealed joints to prevent the migration of drilling fluids and/or ground water.

31. The Contractor shall visit the site and must be aware of all structures and site limitations at the directional drill crossing and provide the Engineer with a drilling plan outlining procedures to prevent drilling fluid from adversely affecting the surrounding area.

32. The general work areas on the entry and exit sides of the crossing shall be enclosed by a berm to contain unplanned spills or discharge.

33. Waste cuttings and drilling mud shall be processed through a solids control plant comprised as a minimum of sumps, pumps, tanks, desalter/desander, centrifuges, material handlers, and haulers all in a quantity sufficient to perform the cleaning/separating operation without interference with the

drilling program. The cuttings and excess drilling fluids shall be dewatered by the Contractor to the extent necessary for disposal in offsite landfills. Water from the dewatering process shall be treated by the Contractor to meet permit requirements and disposed of legally. The cuttings and water for disposal are subject to being sampled and tested. The construction site and adjacent areas will be checked frequently for signs of unplanned leaks or seeps.

34. Equipment (graders, shovels, etc.) and materials (such as groundsheets, hay bales, booms, and absorbent pads) for cleanup and contingencies shall be provided in sufficient quantities by the Contractor and maintained at all sites for use in the event of inadvertent leaks, seeps, or spills.

35. Waste drilling mud and cuttings shall be dewatered, dried, and stock piled such that it can be loaded by a front end loader, transferred to a truck and hauled offsite to a suitable legal disposal site. The maximum allowed water content of these solids is 50 percent of weight.

36. Due to a limited storage space at the worksites, dewatering and disposal work shall be concurrent with drilling operations. Treatment of water shall satisfy regulatory agencies before it is discharged.

3.4 THRUST BLOCK INSTALLATION

A. All plugs, caps, tees, bends, and other fittings shall be provided with adequate thrust blocks. Thrust blocks shall be constructed to the minimum dimensions shown on the drawings or as directed by the Engineer. Thrust blocks shall be made of ready mix concrete having a compressive strength of 28 days of 3,000 PSI and shall bear directly against the undisturbed trench wall. Where possible, the concrete shall be so placed that the fitting joints will be accessible for repair. All bolts and pipe joints shall be protected against contact with thrust block concrete by the installation of a 20 mil polyethylene film placed between the fittings and the concrete. Where any section of a main is provided with concrete thrust blocks, the hydrostatic pressure test shall not be made until three days after installation of the concrete thrust blocks unless otherwise approved by the Engineer. Where trench conditions are, in the opinion of the Engineer, unsuitable for thrust blocks, the Contractor shall provide steel tie rods and socket clamps to adequately anchor the piping. All tie rods and clamps shall be given a bituminous protective coating or shall be galvanized.

B. Concrete for thrust blocks shall consist of a ready mix of Portland Cement, fine and coarse aggregate, and water to produce concrete with a minimum compressive strength at 28 days of not less than 3,000 PSI when tested in accordance with ASTM C39. Sakrete or any similar material will not be permitted under any circumstances.

3.5 VALVE INSTALLATION

A. All valves shall be installed in accordance with the manufacturer's instructions. Before setting each valve, the Contractor shall make sure the interior is clean and test opening and closing. Valves shall be set with stems plumb, unless horizontal installation is called for on the plans, and at the exact locations shown. Trench backfill shall be tamped thoroughly for a distance of 3'-0" on each side of valves boxes.

3.6 VALVE BOX INSTALLATION

A. All valve boxes shall be installed in accordance with the manufacturer's instructions. A valve box shall be installed over each underground valve. All boxes shall be installed in accordance with the manufacturer's instructions and set plumb with their top flush with finished grade.

3.7 FIRE HYDRANT INSTALLATION

A. All fire hydrants shall be installed in accordance with the manufacturer's instructions. Fire hydrants shall be located as shown. Each hydrant shall be connected to the main with a 6-inch branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with the pumper nozzle facing the roadway and with the center of the lowest outlet not less than 18 inches above the finished grade. Hydrants shall be rodded to the 6-inch branch tee. Unless otherwise specified, the backfill around hydrants shall be thoroughly compacted to the final grade immediately after installation in order to put the hydrant into service as soon as practicable. Not less than nine (9) cubic feet of clean crushed stone shall be placed around the base of the hydrant to insure drainage of the hydrant barrel. A 12" x 12" x 6" solid concrete block or pad shall be set under the fire hydrant foot for a solid bottom.

3.8 AIR RELIEF VALVE INSTALLATION

A. All air relief valves shall be installed in accordance with the manufacturer's recommendations at locations shown and in accordance with details provided on the Project Plans.

B. All air relief valve shall be installed in a precast concrete manhole as shown in detail on the plans. Manhole sections shall be set plumb and on a firm foundation. Each joint between sections and all wall openings shall be sealed inside and out with a 2:1 sand-cement mortar and made watertight. When so directed, the Contractor shall install a flat slab top, precast with a standard frame and cover. Flat slab tops shall be traffic bearing unless noted otherwise.

3.9 CONNECTIONS TO EXISTING WATER SYSTEMS

A. Connections to existing water distribution systems will be allowed when proper precautions are taken to protect the existing system. The Contractor shall be responsible for determining and utilizing all measures required by the water utility Owner in tapping existing water mains. The Contractor shall also make appropriate arrangements with the water utility Owner based on the size and location of the tap indicated on the drawings.

B. If the proposed water extension does not begin at an existing valve, a new tapping sleeve and valve of the size specified shall be installed at the required location as specified. All tapping sleeves and valves shall be installed in accordance with MSS SP-60. Alternately, if water service interruption is acceptable to the Owner, a valve may be installed at the appropriate location in the existing water piping.

C. The Contractor shall be responsible for installing all backflow prevention devices or other "jumpers" as may be required by the Plans or the water utility Owner at the point of connection with the existing water system. For extensions of the existing system, the valve isolating the new system from the existing system will not be opened until all other water system construction has been completed, satisfactorily passed all testing in compliance with these specifications, and been certified by the Engineer unless specifically authorized by the water utility Owner.

3.10 INSTALLING NEW WATER SERVICE LINES

A. For extensions of the existing water system, all buildable lots adjacent to the extension shall have a water service line provided unless otherwise directed. Additional service lines may be installed by the Contractor as directed and authorized by the Engineer.

B. All water service connections and their associated appurtenances shall conform to the latest revision of AWWA C800.

C. In general, service lines shall be constructed from the public water system to a point located at the edge of the public right-of-way or the water easement. Domestic service lines shall consist of a ¾- inch (for a single service) or 1-inch diameter pipe (for a double service), as listed in the Bid Schedule and/or shown on the Plans.

D. The standard water service connection shall be Type "K" flexible copper tubing unless shown otherwise on the drawings, and shall connect to the main at a brass corporation stop tapped into the main line.

E. The Owner-maintained portion of each water service line shall have a minimum of 3 feet of cover.

F. The meter box unit shall be a complete unit with all pipe nipples, valves, yoke, and bottom installed and connected prior to delivery.

3.11 REINSTATING EXISTING WATER SERVICE LINES

A. Where existing water mains are being rehabilitated, water service lines shall be constructed for each property that is occupied by a business or dwelling if it is currently served by the system being rehabilitated.

B. The Contractor shall be responsible to locate and connect all existing water service lines to the new main. In the event a service is missed during construction, the Contractor shall return to the site and perform all work necessary to reinstate the connection. The Contractor will be compensated in accordance with the original contract unit pricing; however, re-mobilization to the site will not be paid for.

3.12 JOINT CONSTRUCTION

A. Make pipe joints in accordance with the following requirements:

1. Gasketed joints for ductile-iron water piping shall be made in accordance with AWWA C600 and AWWA M41.

2. Gasketed joints for PVC piping shall be made using jointing materials in accordance with AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D2774 or ASTM D3139 and pipe manufacturer's written instructions.

3. Pressure-sealed joints for copper tubing shall be made using proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.

3.13 FIELD QUALITY CONTROL

A. Testing:

1. After the pipeline has been satisfactorily constructed, complete with the required fire hydrants, services, and all other appurtenances, and the trench sufficiently backfilled, the newly constructed pipeline and valved sections shall be subjected to hydrostatic pressure tests in strict accordance with AWWA C600 (for ductile iron pipe and appurtenances), AWWA C605 (for PVC pipe and appurtenances), and the contract material specifications. Valves shall be closed or line plugged at both ends of each completed section of the pipeline slowly filled with potable water. At no time shall more than 4,000 linear feet of main be tested. As the main is being filled with

water in preparation of the tests, all air shall be expelled from the pipe. The main shall be subjected to a maximum hydrostatic pressure of 200 pounds per square inch (at the lowest point of the line section under test) and minimum 150 psi at the high point of the test section for a period of two (2) hours. In no case shall the test pressure exceed the rated working pressure of any joints, restraints, valves, or fittings. Pressure shall be applied to the main by means of a hand pump for small lines or by use of a gasoline pump or fire engine for larger lines.

2. The Contractor shall be responsible for paying any costs that may be associated with the water utilized in the flushing, testing and sterilization process in accordance with the requirements of the authorities having jurisdiction. Any costs associated with paying for this water shall be incorporated into the unit price for water line installation.

3. Air removal: Before applying the specified test pressure, air shall be expelled completely from the section of piping under test. If permanent air vents are not located at all high points, corporation cocks shall be installed at these points to expel the air as the line is filled with water. After the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of a successful pressure test, the corporation cocks shall be removed and the pipe plugged.

4. Examination: Any exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with reliable material, and the test shall be repeated until satisfactory results are obtained.

5. Testing of all services, their appurtenances and all valves (regardless of type) shall conform to the appropriate AWWA standard.

6. The test allowance shall be determined at 15-minute intervals by means of volumetric measurement of the water added during the test until the rate has stabilized at the constant value for three consecutive 15-minute periods.

7. Test allowance is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified test pressure after the pipe has been filled with water and the air expelled. Allowable leaking within the new water line shall be determined using the following equation:

$$L = \frac{SDP^{0.5}}{148{,}000}$$

Where: L = testing allowance (makeup water), in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of the pipe, in inches

P = average test pressure during the hydrostatic test, in pounds per square inch (gauge)

8. The allowable leakage for various pipe sizes and test pressures is graphically represented below:

ALLOWABLE MAKEUP WATER PER 1,000 FEET OF PIPELINE (Gallons/Hour)														
TEST PRESSURE (P.S.I.)	**PIPE DIAMETER**													
	2	**3**	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**24**	**30**	**36**
100	0.14	0.20	0.27	0.41	0.54	0.68	0.81	0.95	1.08	1.22	1.35	1.62	2.03	2.43
125	0.15	0.23	0.30	0.45	0.60	0.76	0.91	1.06	1.21	1.36	1.51	1.81	2.27	2.72
150	0.17	0.25	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49	1.66	1.99	2.48	2.98
175	0.18	0.27	0.36	0.54	0.72	0.89	1.07	1.25	1.43	1.61	1.79	2.15	2.68	3.22
200	0.19	0.29	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72	1.91	2.29	2.87	3.44
225	0.20	0.30	0.41	0.61	0.81	1.01	1.22	1.42	1.62	1.82	2.03	2.43	3.04	3.65
250	0.21	0.32	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92	2.14	2.56	3.21	3.85
275	0.22	0.34	0.45	0.67	0.90	1.12	1.34	1.57	1.79	2.02	2.24	2.69	3.36	4.03
300	0.23	0.35	0.47	0.70	0.94	1.17	1.40	1.64	1.87	2.11	2.34	2.81	3.51	4.21

9. No leakage will be allowed under the above tests for piping in buildings and structures.

10. Cracked or defective pipe, joints, fittings, valves, or hydrants discovered in consequence of this test shall be removed and replaced with sound materials, and the test shall be repeated until the test results are satisfactory. Precautions shall be taken to remove or otherwise protect equipment in, or attached to, pipe to prevent damage or injury thereto.

11. Tests of insulated and concealed piping shall be made before the piping is covered or concealed. No leakage will be allowed under the above tests for piping under or in buildings.

12. The Contractor shall notify the Engineer when the work is ready for testing with all testing done in the presence of the Engineer. All labor, equipment, water and materials, including meters and gauges shall be furnished by the Contractor at his own expense.

13. When hydrants are in the test section, the test shall be made against the main valve in the hydrant.

B. Sterilization:

1. After the pressure-leakage test is completed and before the use of water is permitted from any portion of newly constructed water line which will hold or carry potable water, it shall be flushed, cleaned and chlorinated in the presence of and as directed by the Engineer or his Representative.

2. Pipelines may, at the option of the Contractor, be chlorinated in sections isolated by means of gate valves or other approved means.

3. Each unit of the completed water line shall be sterilized as specified below as prescribed by AWWA C651 “continuous feed” method. The unit to be sterilized shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. The chlorinating material shall provide a chlorine dosage of not less than 50 PPM and shall be introduced into the water line in an approved manner. The retention time shall be at least 24 hours and shall produce not less than 25 PPM of chlorine at the extreme end of the line at the end of the retention period. All valves on the lines being sterilized shall be opened and closed several times during the contact period.

4. Following chlorination, all treated water shall be thoroughly flushed from the pipe until the replacement water shall, upon test, both chemically and bacteriologically, be proven equal to the water quality served to the public from the existing water supply system, and be approved by authorities having jurisdiction. The Contractor shall be responsible for taking the necessary precautions, such as dechlorination, to ensure that the flushing does not harm the environment and complies with all appropriate regulatory requirements. The Contractor shall pay for all bacteriological testing costs. Bacteriological tests shall be performed by a State Approved Laboratory.

5. During the flushing period, each fire hydrant on the line shall be opened and closed several times to remove potential concentrations of chlorinated water. The Contractor shall arrange for the collection of water samples in properly sterilized containers for bacterial examination and shall coordinate the testing of collected samples. The requirements of AWWA C651 shall dictate the number and locations of samples to be collected and tested based on the length and configuration of the constructed system. No water samples shall be collected from a fire hydrant. All cost for testing shall be included in the unit price for water line installation. Prior to acceptance of the water system improvements, two (2) complete, consecutive sets of samples, collected at least 16 hours apart, must pass the required bacteriological testing or the sterilization process repeated until these results are achieved. Test results shall be provided to the Engineer by the authorized testing agency/firm immediately upon completion of the testing procedure.

6. Final connections to existing mains shall be made where indicated on the drawings or as directed after satisfactory samples have been obtained.

END OF SECTION 332660

SECTION 332700 SANITARY SEWER PIPE AND APPURTENANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Where specific standards are referenced within this document, the most current specification and/or latest revision shall apply.

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.

2. Valves and appurtenances.

3. Transition couplings.

4. Manholes and appurtenances.

1.3 SCOPE OF WORK

A. Furnish all labor, equipment, materials, incidentals, and temporary facilities necessary to install and complete the sanitary sewer and/or force main installation in accordance with the plans. All pipe and appurtenance material shall be of the type and class specified herein.

B. All pipeline and appurtenance excavation, bedding, pipe laying, jointing and coupling of pipe joints and backfilling shall be completed as described herein.

1.4 DEFINITIONS

A. AASHTO – American Association of State Highway and Transportation Officials

B. ACPA – American Concrete Pavement Association

C. ANSI – American National Standards Institute

D. API – American Petroleum Institute

E. ASTM – American Society for Testing and Materials

F. AWWA – American Water Works Association

G. CFM – Cubic Feet per Minute

H. DIP – Ductile Iron Pipe

I. HDD – Horizontal Directional Drilling

J. HDPE – High Density Polyethylene

K. LB – Pound

L. Min. - Minute

M. NFPA – National Fire Protection Association

N. NSF – National Sanitation Foundation

O. NSPT – National Standard Pipe Thread

P. PE – Polyethylene

Q. PPM – Parts Per Million

R. PSI – Pounds per Square Inch

S. PSIG – Pounds per Square Inch (Gauge)

T. PVC – Polyvinyl Chloride

U. RCP – Reinforced Concrete Pipe

1.5 SUBMITTALS

A. All submittals shall be in accordance with the requirements of Division 1 of these specifications.

B. Shop drawings or submittals shall be required for the following:

1. Drawings and descriptive data on manholes (including wall thicknesses, vertical dimensions, and deflection angles), concrete used in manufacture of manholes and precast inverts, rubber gaskets, joint sealant, flexible manhole sleeves and joints, frames and covers, inverts, and manhole

steps shall be submitted to the Engineer for review prior to their manufacture.

2. All sizes and types of pipe.

3. All pipe fittings, valves and appurtenances.

4. All transition couplings.

C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Operation and Maintenance Data: For specialties valves and appurtenances to include in emergency, operation, and maintenance manuals.

E. When utilized on the project, the Contractor shall submit detailed plans and a description outlining all provisions and precautions to be taken by the Contractor regarding the handling of existing wastewater flows during the sewer line connections, replacement or startup of the sewage pumps. This plan must be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials and all other incidental items necessary and/or required to ensure proper protection of the facilities, including protection of the access and bypass pumping locations from damage due to the discharge flows, and compliance with the requirements and permit conditions. The submitted work schedule shall minimize the interruption and/or bypassing of wastewater flow during construction. The plan shall include the use of a "High Water Alarm" in the manhole or structure used for bypass pumping. The submittals shall include electrical schematics and control panel information for the pumps including start/stop and alarming configurations. No construction shall begin until all provisions and requirements have been reviewed by the Owner. The Contractor shall allow 30 days for review of this plan.

1. The plan shall include but not limited to details of the following:

    a. Staging areas for pumps;
    b. Plan showing proposed equipment and piping layouts including details of tie-ins to existing sewer lines and/or force mains;
    c. List of pump sizes, valves, piping, fittings and other appurtenances;
    d. Method of noise control for each pump and/or generator;
    e. Method for controlling and monitoring the pumps.
    f. Contingency plan for a sanitary sewer overflow caused by the diversion of the sewer flow.

1.6 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall coordinate material deliveries with the manufacturer/supplier. All materials shall be handled and stored in accordance with the manufacturer's recommendations using methods that will prevent damage to the materials. Further, all manhole components shall be handled and stored in accordance with the ASTM C891.

B. Preparation for Transport: Prepare valves according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.

2. Protect valves against damage to threaded ends and flange faces.

3. Set valves in best position for handling. Set valves closed to prevent rattling.

C. The Contractor shall unload pipe and appurtenances so as to avoid deformation or other injury thereto. Pipe shall not be placed within pipe of a larger size and shall not be rolled or dragged over gravel or rock during handling. If any defective material is discovered after installation, it shall be removed and replaced with sound pipe or shall be repaired by the Contractor in an approved manner and at his own expense.

D. The Contractor shall store all pipe and appurtenances on sills above storm drainage level and deliver for laying after the trench is excavated. Do not store any plastic materials in direct sunlight. All plastic materials shall be supported to prevent sagging and bending. All plastic materials shall also be covered with tarps if exposed to the elements for extended periods of time.

E. Protect pipe, pipe fittings, and seals from dirt and damage.

F. Handle all materials in accordance with the manufacturer's written instructions.

G. When any material is damaged during transporting, unloading, handling or storing, the undamaged portions may be used as needed, or, if damaged sufficiently, the Engineer will reject the material as being unfit for installation. The Engineer will reject any ductile iron pipe with a damaged cement lining.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: The interruption of sewer flows within the collection system or service to any occupied structure or facility will not be permitted unless specifically approved by the utility owner. The Contractor shall be responsible for maintaining sewer flows at all times.

1. When by-pass pumping of sewer flows is necessary, the Contractor shall submit a by-pass pumping work plan to the Engineer and utility owner in conjunction with the submittal of a construction schedule. The plan shall include a primary pump and an identical standby pump.

2. Notify Engineer and utility owner no fewer than 72 hours in advance of proposed by-pass pumping of sewer flows.

3. Do not proceed with by-pass pumping of sewer flows without utility owner's written permission.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with all requirements of utility owner providing sanitary sewer service including the connection of new collection system piping.

2. Comply with all standards of authorities having jurisdiction for sanitary sewer service piping, including materials, installation, and testing.

B. All piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: All associated materials shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. The design, installation and operation of any temporary pumping system, when required to maintain sewer flows in the existing system, shall be the Contractor's responsibility. The Contractor shall demonstrate experience in the design and operation of temporary bypass pumping systems or employ the services of a vendor who can demonstrate this experience. The Contractor or vendor shall provide at least five (5) references of projects of a similar size and complexity as this project performed within the past three (3) years. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

1.9 COORDINATION

A. Coordinate any connections to the existing sanitary sewer with the utility owner.

PART 2 - PRODUCTS

2.1 BYPASS PUMPING EQUIPMENT

A. Equipment:

1. All pumps utilized for bypass pumping shall be centrifugal, end suction, fully automatic self-priming units that do not require the use of foot valves in the priming system. The pumps may be electric or diesel powered. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of sewer flows. The pumps shall not be hydraulic submersible type.

2. Pumps shall be equipped with sound attenuation enclosures which reduce operating noise to 66 dB at 30 feet. Pump sizing shall be in accordance with this Specification.

3. The bypass pumping system shall include the necessary stop/start controls for the pumps.

4. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. A backup pump of size equal to the largest bypass pump shall be included. The backup pump shall be on-line, isolated from the primary system by a valve.

5. Temporary discharge piping shall be constructed of rigid pipe with positive, restrained joints. Aluminum “irrigation” type piping or glued PVC pipe will not be allowed. Discharge hose will only be allowed in short sections and as accepted by the Owner.

6. Allowable piping shall be as specified herein or as otherwise approved in writing by the Engineer.

B. System Description:

1. Design Requirements:

a. The bypass pumping system shall have sufficient capacity to pump a peak flow equal to or greater than the capacity of the sewer line being bypassed. The Contractor shall provide, maintain and operate all necessary pipeline plugs, pumps of adequate size to handle the peak flow, and temporary discharge piping to ensure that the total influent flow can be safely diverted around the affected section to be repaired or replaced. Bypass pumping systems will be required to be operated 24 hours per day from the time the existing sewer line is

removed from service until the new sewer line is put into service and has been determined to be Substantially Complete by the Owner.

b. Temporary bypass pumping during construction may be accomplished by utilizing existing sanitary sewer manholes upstream and downstream of the affected section. The Contractor shall verify location of all utilities, size of fittings, couplings and all other bypass requirements as previously noted. The bypass connection and piping shall be installed and tested prior to bypassing.

c. When bypass pumping from an existing valve vault or pump station, the Contractor shall verify that all necessary components of the existing system are in good working condition. The Owner shall be responsible for operating these valves during construction/upgrades at existing facilities. The Contractor shall coordinate with the Owner's personnel regarding the operation of these facilities and providing a minimum of five (5) days' notice to the Owner prior to conducting any verification or performing any construction operations.

2.2 PIPE MATERIALS

A. All materials shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs and other imperfections, and true to theoretical shapes and forms throughout. All materials shall be subject to the inspection of the Engineer at the plant, trench, or other point of delivery, for the purpose of culling and rejecting materials which do not conform to the requirements of these specifications. Such material shall be marked by the Engineer and the Contractor shall remove it from the project site upon notice being received of its rejection.

B. As particular specifications are cited, the designation shall be construed to refer to the latest revision under the same specification number, or to superseding specifications under a new number except provisions in revised specifications which are clearly inapplicable.

2.3 DUCTILE IRON SEWER PIPE (DIP) – GRAVITY SEWER AND FORCE MAINS

A. Ductile Iron Pipe shall be as manufactured in accordance with AWWA C151, ASTM A-746, ANSI Specification A21.50 and A21.51 and shall be Class 350 unless otherwise specified on the drawings or in the Bid Schedule.

1. The pipe interior shall be cement mortar lined and seal coated, standard thickness, in accordance with ANSI Specification A21.4.

2. The exterior of all pipe shall be coated with either a coal or asphaltic base bituminous pipe coating in accordance with ANSI Specification A21.8.

3. Pipe shall be furnished with Slip Joints, Mechanical Joints, or Flanged Joints as indicated on the drawings and in accordance with the specifications described below:

B. Slip Joints: Slip or “push-on” joints shall be manufactured in accordance with AWWA C111. Pipe thickness shall be Class 350 as determined by AWWA C150.

1. Bells of “slip” joint pipe shall be contoured to receive a bulbshaped circular rubber gasket, and plain ends shall have a slight taper to facilitate installation. The gasket and associated lubricant shall be furnished by the pipe manufacturer and shall be manufactured in accordance with ANSI Specification A21.11.

2. The jointing shall be done by guiding the plain end into the bell until contact is made with the gasket and by exerting a sufficient compressive force to drive the joint home until plain end makes full contact with the base of the bell. In force main installations, no joint may exceed a maximum deflection of 11 inches in an 18-foot joint of pipe (3 degrees).

C. Restrained-Joint Ductile Iron Pipe:

1. All restrained joint pipe shall be ductile iron, manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51. The rated working pressure for pipe sizes 4-inch through 24-inch shall be 350 PSI and 250 PSI for pipe sizes 30-inch through 64-inch as determined by AWWA C150 unless otherwise noted. Push-on joints for such pipe shall be in accordance with ANSI/AWWA C111/A21.11.

2. Restrained joints shall be restrained push-on joints, TR Flex by U.S. Pipe and Foundry; Lok-Fast by American Cast Iron Pipe Company, or equal. Joints shall be suitable for 250 psi working pressure and be fabricated of heavy section ductile iron casting. Bolts and nuts shall be low carbon steel conforming to ASTM A307, Grade B.

3. External loading conditions shall not deflect the pipe more than 3% in the horizontal direction.

D. Mechanical-Joint Ductile Iron Pipe:

1. All mechanical joint pipe shall be ductile iron manufactured in accordance with AWWA C111. Pipe shall be manufactured in accordance with AWWA C151, and the pipe thickness shall be Class 350 as determined by AWWA C150 unless otherwise noted.

2. All bolts shall be tightened by means of torque wrenches in such a manner that the follower shall be brought up toward the pipe evenly. If effective

sealing is not obtained by tightening the bolts to the specified torques, the joint shall be disassembled and reassembled after thorough cleaning.

3. Bolts for mechanical joints shall be high grade steel, low alloy type, with tee or hex head and American Standard threads. Mechanical joint gland shall be gray iron and shall utilize a plain rubber gasket.

E. Flanged-Joint Ductile Iron Pipe:

1. Flanged pipe shall have flanges with long hubs, shop fitted on the threaded end of the pipe.

2. Where required, flanges shall be tapped for stud bolts. Flanges shall be accurately faced at right angles to the pipe axis and shall be drilled smooth and true, and covered with coal tar pipe varnish or otherwise protected against corrosion of flange faces. Flange faces shall be cleaned to bare metal with wire brushed before installation of pipe.

3. Ductile iron flanged joint pipe shall have a thickness of Class 53 minimum and shall conform to AWWA C110 and AWWA C115. Pipe shall be ordered in lengths needed as no pipe shall be cut, threaded or flanged in the field. All pipe shall have Class 125 flanges conforming to AWWA C110 unless otherwise specified.

4. Flanged joints shall be made up with through bolts of the required size. Bolts shall be zinc plated, with good and sound, well fitting threads, so that the nuts may be turned freely by hand.

5. Flanged joints shall be made up using only full face gaskets with a minimum thickness of 1/8-inch. Ring gaskets are not acceptable. Gasket material shall be rubber or approved equal as recommended by the Manufacturer.

6. Connecting flanges shall be in proper alignment and no external force shall be used to bring them together.

F. Long Span Pipe: “Long span” type ductile iron pipe shall be used for unsupported spans greater than 20’-0”. “Long span” ductile iron pipe and associated pipe joints shall be designed by the pipe manufacturer specifically for elevated crossings with unsupported spans shown on the drawings. The Contractor shall submit shop drawings from the pipe manufacturer for the long span pipe. Shop drawings shall include material specifications for the pipe and joints, and shall specify locations of joints with respect to the pier locations shown on the drawings. Long span ductile iron pipe shall be as manufactured by American, U.S. Pipe, or equal.

2.4 POLYVINYL CHLORIDE SEWER PIPE (PVC)

A. Gravity: Polyvinyl Chloride Pipe shall be as manufactured in accordance with ASTM D-3034, latest edition, and shall be suitable for use as a gravity sanitary sewer pipe. The standard dimension ratio (SDR) shall be 35 unless otherwise specified on the contract drawings.

B. All polyvinyl chloride pipe joints shall be of an integral bell and spigot of the same material as the pipe. It shall have a solid cross-section with rubber "0" ring securely locked in place at the point of manufacture.

C. Force Main: Polyvinyl chloride pipe shall be as manufactured in accordance with ASTM D-2241, latest edition, and shall be suitable for use as a sanitary sewer force main pipe. The standard dimension ratio (SDR) shall be 18 or 21 as shown on the contract drawings. PVC force main piping shall have a green exterior color. Under no circumstances shall pipe with a blue exterior color be accepted. No pipe joint may exceed a maximum deflection of 11 inches in an 18-foot joint of pipe (3 degrees).

D. Where PVC pipe is installed in iron pipe size (IPS), an IPS gasket shall be furnished with each fitting to insure compatibility.

2.5 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

A. High-density polyethylene pipe may be used in the horizontal directional drilling (HDD) of sewer force mains as indicated on the project drawings. Piping shall be extruded from a polyethylene compound and shall conform to the following requirements:

1. The polyethylene resin shall meet or exceed the requirements of ASTM D3350 for PE 3408 material with a cell classification of 335434C or better.

2. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by precompounding in a concentration not less than 2 percent.

3. The maximum allowable hoop stress shall be 800 psi at 73.4 °F.

4. The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe in this project.

5. The pipe and bends shall have a minimum standard dimension ratio (SDR) wall thickness as specified by the Engineer.

6. Joining shall be performed by thermal butt-fusion in accordance with the manufacturer's recommendations.

7. Sanitary sewer pipe exterior shall be green in color or contain green striping.

2.6 BRASS PIPE AND FITTINGS (For Use In Force Main Appurtenances Only)

A. Brass goods furnished under this specification shall be new and unused. All brass pipe and fittings utilized in the assembly of force main appurtenances shall be seamless red brass (copper alloy 230) in accordance with ASTM B43. Metal alloy composition shall be as follows:

1. Copper: 84.0% to 86.0%

2. Lead: 0.05% max.

3. Iron: 0.05% max.

4. Zinc: Remainder (approximately 15%)

B. All brass pipe and fittings shall be regular weight (schedule 40) with threaded ends in accordance with ANSI B1.20.1.

C. Unless otherwise noted, all pipe and fittings shall have a minimum working water pressure of 150 psi and shall conform to AWWA Standard C800.

D. All fittings shall either be stamped or embossed with the manufacturer's name.

2.7 FITTINGS – DIP AND PVC FORCE MAINS

A. Fittings in DIP and PVC force mains shall be required where the sanitary sewer force main has a significant change in alignment or grade. The specifications for the force main fittings are described below:

1. All fittings for any type of sewer force main shall be ductile iron mechanical joint fittings manufactured in accordance with ANSI Specification A-21.1 and AWWA Standard C153 (compact body type) for underground piping for 3 inch through 24 inch diameter fittings and AWWA C110 (full body type) for pipe diameters larger than 24 inches. Where flanged pipe is used ductile iron fittings shall be flanged in accordance with AWWA C153 or AWWA C110 (based on sizing as stated above) for exposed piping. All flanges shall be Class 125 unless otherwise noted.

2. The interior of all fittings shall be cement mortar lined (not less then 1/16-inch), seal coated in accordance with ANSI Specification A21.4 and

AWWA C-104, and suitable for a minimum working pressure of 250 PSI unless otherwise specified.

2.8 GASKETS

A. All rubber gaskets for DIP and PVC pipe and fittings shall be in accordance with AWWA C111. All gaskets shall be a product of the pipe manufacturer, made specifically for the pipe being installed, and shall match the shape and configuration of the joint.

B. Gaskets for ductile iron restrained joint shall be push-on pipe shall provide a trouble-free means of joint restraint for the pipe. These restraining systems shall include gaskets provided by the pipe manufacturer that contain high-strength stainless steel elements spaced around the gasket that develop a dependable gripping action. These push-on restrained joint gaskets shall be rated for a working pressure of 350 PSI for pipe sizes 4-inch through 24-inch and 150 psi for 30-inch pipe.

2.9 WYES, SADDLES, AND SERVICES

A. The materials described within this paragraph shall include all materials to construct a complete sanitary sewer service connection from the gravity sanitary sewer main to the edge of the permanent easement or right-of-way.

B. Wyes and saddles shall be of the same material and strength as the sewer mains on which they are installed. Saddle type fittings shall not be used on new construction or existing mains for pipes 12 inches in diameter or smaller, unless specifically called for in the Plans and/or Specifications or approved in writing by the Engineer. For ductile iron mains greater than 12 inches in diameter, “CB” Romac tapping saddles as manufactured by Romac Industries, Inc. or an approved equal may be used. Unless otherwise specified in the Plans and/or Specifications, house services shall be constructed of 4-inch diameter Schedule 40 PVC pipe or Class 350 psi ductile iron pipe.

C. For taps and services on an existing PVC or VCP sewer mains that are being repaired by trenchless construction methods, flexible saddles as manufactured by NDS/HPI or an approved equal may be utilized. Flexible saddles shall be affixed to the sewer main by stainless steel bands or straps as provided by the manufacturer and by using a two-part epoxy glue uniformly spread over the contact surface of the saddle.

D. A compression coupling by Inserta-Tee or approved equal shall be used to re-connect services to existing 8-inch and larger diameter sewer mains that are being rehabilitated by trenchless construction methods.

E. Wyes shall be placed in sanitary sewers so as to properly serve each existing house and each vacant lot facing or butting on the street or alley in which the sewer is being laid, and at such other locations as may be designated by the Engineer.

F. The location of all wyes, cleanouts, and service lines installed in the work shall be identified on the plans submitted by the Contractor at the end of the project.

2.10 TRANSITION COUPLINGS

A. New Sewer System Construction:

1. In general, transition couplings shall not be permitted in the construction of new sewer systems. For new gravity sewer system construction, the same pipe material shall extend between manholes with no transitions.

2. The pipe material associated with a sewer force main may change, when and where indicated on the Drawings or as approved by the Engineer. When the nominal diameter of the pipe does not change, an approved transition coupling may be used, as necessary, to joint these dissimilar materials. In these cases, a ductile iron, mechanical joint, solid sleeve shall be used to joint these dissimilar materials. The solid sleeve shall be as specified above for fittings and shall be the long body-type. The appropriate gaskets shall be selected based on the outside diameters of the materials being jointed. All gaskets shall be as specified above. In all cases, the gap between the pipe sections being jointed shall not exceed 0.25 inches.

3. Where the nominal diameter of a sewer force main changes, an appropriate ductile iron, mechanical joint reducer, as specified above for fittings, shall be used to joint these materials. The appropriate gaskets shall be selected based on the outside diameters of the material being jointed. All gaskets shall be as specified above.

B. Rehabilitation of Existing Sewer Systems:

1. In general, during the rehabilitation of existing sewer lines, the use of appropriate transition couplings shall be permitted as approved by the Engineer. All changes in pipe size within the gravity sewer collection system shall require the installation of a manhole as specified elsewhere.

2. Jointing for gravity sewer lines shall require an appropriate shielded rubber sewer coupling. In all cases, the gap between the pipe sections being jointed shall not exceed 0.25 inches. The coupling shall consist of a rubber sleeve conforming to ASTM C425 and ASTM C1173 with a Grade 316 stainless steel shear ring and clamps conforming to ASTM A240. Clamps shall be included with nut and bolt or worm drive take-up

fasteners. “O” ring-type seals shall be provided under each sealing clamp to prevent slippage and provide a positive seal.

3. When the rehabilitation of a sanitary sewer force main requires the use of a transition coupling, the use of such couplings shall be as approved by the Engineer. When the nominal diameter of the pipe does not change, an approved transition coupling may be used, as necessary. In these cases, a ductile iron, mechanical joint, solid sleeve shall be used to joint these materials. The solid sleeve shall be as specified above for fittings and shall be the long body-type. The appropriate gaskets shall be selected based on the outside diameter(s) of the material(s) being jointed. All gaskets shall be as specified above. In all cases, the gap between the pipe sections being jointed shall not exceed 0.25 inches.

4. Where the nominal diameter of a sewer force main changes as part of a rehabilitation project, an appropriate ductile iron, mechanical joint reducer, as specified above for fittings, shall be used to joint these materials. The appropriate gaskets shall be selected based on the outside diameters of the material being jointed. All gaskets shall be as specified above.

2.11 MANHOLES

A. Standard precast concrete manholes sections shall conform to the latest revision of ASTM C 478. Tapered section and transition sections, where required, shall be of eccentric cone design, having the same wall thickness and reinforcement as the cylindrical ring sections. Flat slab tops shall be required for very shallow manholes where shown or specified. Flat slab tops shall ONLY be utilized when/where approved for use by the Engineer. All manholes shall be constructed to the sizes, shapes and dimensions and at the locations shown on the plans. Unless otherwise shown on the plans, manhole diameters, wall thicknesses and bottom thicknesses shall be as follows:

Pipe Size (inches)	Diameter (feet)	Wall Thickness (inches)	Bottom Thickness (inches)
8 through 18	4	5	6
21 through 36	5	5	8
39 through 54	6	6	8
Larger than 54	8	8	8

B. The minimum wall thickness of all manhole riser sections shall be as shown in the table above. Cone sections shall have a minimum wall thickness of 8 inches at their top. Suitable openings for inlet and outlet pipes shall be cast into

the base section for standard connections and into the riser section for drop connections. These openings shall be circular, accurately located and appropriately sized for each manhole.

C. The height or depth of each manhole will vary with the location, but unless otherwise indicated, it shall be constructed such that the top of the manhole matches that of the finished grade surrounding the manhole and the invert is constructed at elevation shown on the plans. As directed by the Engineer (or as otherwise indicated on the plans) the top elevations of some manholes maybe elevated above the finished grade of the surrounding area in wooded or other natural (unmaintained) areas. In all cases, the number of manhole sections (joints) necessary to construct the required height shall be minimized.

D. All manhole and wet well bases shall be monolithically poured complete with a bottom. When indicated on the drawings, precast concrete base sections shall be provided with extended base sections or increased bottom thickness to provide ballast to prevent flotation. Extended bases, as required by the drawings, may be included in the monolithic pour of the base or integrally cast as approved by the Engineer.

E. Minimum compressive strength of concrete shall be 4,000 psi at 28 days and shall comply with ACI 318, and ACI 350. The maximum permissible absorption shall be 6.0 percent. All cement used in the mixture shall be in accordance with ASTM C 150, Type II. Fine aggregate shall be sand, while coarse aggregate shall be crushed gravel, both in accordance with ASTM C 33. All water utilized in the concrete mix shall be potable water. Bases and risers shall be reinforced with a single cage of steel placed within the center third of the wall. Welded wire fabric shall be in accordance with ASTM A 185. Steel reinforcing bars shall be grade 60 deformed steel in accordance with ASTM A 615. The tongue or the groove of the joint shall contain one (1) line of circumferential reinforcement equal in area to that in the barrel of the manhole riser. The minimum cross-sectional area of steel per linear foot shall be 0.12 square inches. Precast manhole sections shall fit together readily.

F. The quality of materials, the process of manufacture, and the finished manhole sections shall be subject to inspection and approval by the Engineer. The manhole sections shall be perpendicular to their longitudinal axis within the limits listed in ASTM C 478.

G. Joint Sealing Materials: Joints shall be sealed by two (2) butyl rubber seals. Each seal shall be as described below:

1. Butyl Seals shall consist of a plastic or paper-backed butyl rubber rope no less than 1 inch cross section. When manholes are larger than 4 feet diameter or have a larger than normal space between the joints, the length and or diameter of the rope shall be increased as required to achieve a seal. Butyl rubber material shall conform to Federal Specification SS-

S210A, AASHTO M-198, Type B - Butyl Rubber and as follows: maximum of 1 percent volatile matter and suitable for application temperatures between 10 and 100 degrees F. Butyl rubber shall be applied to clean, dry surfaces only. Use of 2 independent wraps of Butyl Rubber placed side-by-side (not stacked) qualifies for the requirement of two seals.

2. Internal O-Ring Gaskets and Internal Rubber Gaskets shall not be used.

H. Manhole Sleeves and Entrance Joints: Flexible manhole sleeves or flexible manhole entrance joints shall be installed on all pipes entering and leaving precast manholes. Manhole openings shall be accurately core drilled or cast in place. Sleeve and joint material shall be of high quality synthetic rubber which complies with the requirements of ASTM Specification C 923. Sleeve hardware (clamps, bands, straps, draw bolts, nuts, etc.) shall be stainless steel and make a watertight union. Sleeves shall be Kor-N-Seal I, Kor-N-Seal II, flexible connectors models 72, 73, 74, 107, 117, 126, 127, 128, 1610, or 1612 as manufactured by EPCO, or shall be as manufactured by Lock Joint a subsidiary of Gifford-Hill-American, Inc. or comparable sleeves as manufactured by the Press Seal Gasket Corporation, or equal. Flexible manhole entrance joints may be cast into the wall of the manhole base or may be installed by coring the manhole wall and installing the flexible connector to form a tight waterstop. Joints shall be watertight under a 30 foot head of water. Flexible manhole entrance joints shall be A-LOK Joints as manufactured by the A-LOK Products Corp., Press Wedge II as manufactured by the Press Seal Gasket Corp., or equal. Flexible manhole sleeves and flexible manhole entrance joints shall be installed in accordance with instructions of their manufacturer.

I. Manhole Steps:

1. Steps shall be a copolymer polypropylene plastic reinforced with a ½ inch diameter, grade 60 bar and have serrated tread and tall end lugs. Step pull out strength shall be a minimum of 2,000 pounds when tested according to ASTM C-497.

2. Steps shall be required in all structures with a depth greater than four (4) feet. Steps shall be vertically aligned and uniformly spaced for the entire depth of the structure. Steps shall be located in the structures along the vertical face of the eccentric cone and so as to land upon a bench.

3. Steps shall be vertically spaced between 12 and 16 inches on center. Step width shall be a minimum of 12 inches. Steps shall protrude from the wall of the structure a minimum of five (5) inches and a maximum of seven (7) inches.

4. Secure steps to the wall with a compression fit in tapered holes. Steps shall not be vibrated or driven into freshly cast concrete. Steps shall not be grouted in place.

J. Precast Grade Rings and Brick:

1. Precast reinforced concrete grade rings or brick shall be used to adjust ring and covers to finished grade. No more than 12 vertical inches of grade rings or brick will be allowed per manhole. Grade rings shall conform to ASTM C478 and shall be no less than 6 inches and no more than 9 inches in height with a diameter matching that of the frame and cover.

2. All brick used shall be solid and shall be made from Concrete, Clay, or Shale, and shall be of standard building size.

K. Manhole Frames and Covers:

1. Frames and covers shall be cast iron of superior quality, tough and even texture. Castings shall be gray iron conforming to ASTM A 48, size as indicated, free from blow holes, porosity, hard spots, shrinkage distortion, or other defects, and well cleaned. The bearing surface between frame and cover shall be machined to prevent rocking and rattling.

2. The standard manhole casting shall be designed for heavy duty use with a 190 pound frame and 125 pound cover. All frames and covers shall comply with AASHTO HS20 loading requirements as well as North Carolina DOT standard 840.54. The minimum opening within the interior of the frame shall be 24-inches. The frame shall have a 4-inch minimum width flange with the cover being 26 inches in diameter and shall include an indented top design with lettering cast into the cover, using the wording "SANITARY SEWER." Acceptable products include U.S. Foundry USF 669 ring and KL cover, or an approved equal.

3. Special waterproof manhole frame and covers shall be installed only at those locations indicated on the contract drawings. Watertight rings and lids shall be U.S. Foundry 669-KL-BWTL with a 125-pound cover. Ring shall have a flat type gasket and cover shall be bolted down with a minimum of four (4) bolts.

4. After the manhole has been set in its final position, set the manhole frame to the required elevation using no more than 12 inches of precast concrete grade rings, or bricks sealing all joints between cone, adjusting rings, and manhole frame. When grade rings or bricks are used, grout with non-shrink grout. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted so as to conform to the exact slope, crown and grade of the existing surrounding pavement. Manhole frames which are placed above final grade will have frames attached to manhole cone section by means of 5/8-inch diameter stainless steel anchors and washers. One anchor bolt shall be provided per hole.

5. When flat slab tops are utilized, frames shall be cast into the top for access into manholes.

L. Manhole Inverts and Benches:

1. All sanitary sewer manholes (excluding wet well structures) shall include inverts and benches. Manhole inverts and benches shall be constructed of brick and cement grout or precast concrete in accordance with the standard details shown on the drawings. Inverts shall have a "U" shaped cross section of the same diameter as the invert of the sewers which they connect. "U" shaped inverts shall be constructed to a minimum depth of 6 inches for 8 inch sewers and to full pipe diameter depth of the outlet sewer main for larger mains. The manhole invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in direction of flow through the manhole, whether horizontal or vertical, shall be made with true tangent curve(s) with as large a radius as the size of the manhole will permit. Provide a ½ inch radius at the intersection of 2 or more channels. The minimum concrete thickness in the invert of the channel shall be 2 inches, not including the manhole base thickness. The fall across the manhole invert shall be as noted on the plans.

2. Manhole benches shall be constructed with a slope of 1 inch per foot (8 percent) sloped toward the invert channel. Finish benches shall provide a uniform slope from the high point at the manhole wall to the low point at invert channel. Provide a radius (1/8 inch to 1 inch range is acceptable) at the edge of the bench and channel.

3. When the invert and bench are not constructed by the precast manufacturer, the Contractor shall construct the invert and bench using 3,000 psi concrete or non-shrink grout. Non-shrink grout may be plastered over layered brick and mortar in lieu of solid non-shrink grout invert.

4. Gradual smooth sided depressions and high spots may be allowed so long as diameter of invert channel ranges from 1/4 inch less than, or 1/2 inch more than the nominal pipe diameter are maintained. Voids, chips, or fractures over 1/8 inch in diameter or depth shall be filled with a non-shrink grout and finished to a texture reasonably consistent with the bench surface. All work from collar down shall have a steel trowel finish.

5. Pipe Openings: Pipe openings shall provide clearance for pipe projecting a minimum of 2 inches inside the manhole. The crown of smaller diameter pipes shall be no lower than the crown of the outlet pipe. Grout pipe penetrations, including pipe crown, to provide a smooth, uniform finish using non-shrink grout.

M. Manhole Drops: Standard drop manholes will be constructed only at those locations shown on the drawings or as approved by the Engineer. The design of the drop connection shall be in accordance with the standard detail drawing. The cost of the extra pipe, labor, etc. required to construct a drop manhole will be included in the unit price for the drop manhole at the depths indicated.

N. Manhole Vents:

1. Where designated on the contract drawings, a 4-inch diameter vent pipe shall be installed as an integral part of the manhole. The vent pipe is to be tapped into the upper most section of the manhole, anchored in concrete and extended vertically to the elevation shown on the drawings. The pipe shall have a reverse bend and screen to prohibit rain and foreign materials from entering pipe.

2. The pipe material shall be Schedule 40 Steel with a coal tar interior lining in accordance with AWWA C203 and have an exterior finish consisting of two (2) coats of epoxy paint as approved by the Engineer.

2.12 SWING CHECK VALVES

A. Swing check valves smaller than 3 inches in diameter shall be single disc with renewable bronze seat rings, bronze discs or disc rings and bronze disc hinges and pins and shall be designed to give a full diameter passage.

B. Swing check valves 3 inches in diameter and larger shall be constructed with heavy cast-iron or cast-steel body with a bronze or stainless steel seat ring and a non-corrosive shaft for attachment of weight and lever. The valves shall absolutely prevent the return of water back through the valve when the inlet pressure decreases below the outlet pressure. The valve disc shall be of cast-iron or cast-steel and shall be suspended from a non-corrosive shaft.

2.13 PLUG VALVES

A. Plug valves shall be solid one piece, cast of ASTM A536 ductile iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the shaft. Plug shall not contact the seat prior to 90 percent closed. Plug facing shall be Chloroprene (CR), or other resilient facing suitable for the application.

B. Bodies shall be of ASTM A126 Class B cast iron. Port shall be rectangular. Port area shall be 100 percent of Standard class pipe area. Bearings shall be sleeve type and made of sintered, oil-impregnated permanently lubricated type 316 stainless steel per ASTM A743 Grade CF8M.

C. Seats shall be 1/8-inch thick welded overlay of not less than 95 percent pure nickel. Seat shall be at least ½-inch wide and raised. The raised surface shall

be completely covered with nickel to insure that the resilient plug face contacts only the nickel seat.

D. Adjustable Packing shall be of the multiple V-ring type, with a packing gland follower. Shaft seals shall permit inspection, adjustment or complete replacement of packing without disturbing any part of the valve or actuator assembly except the packing gland follower.

E. Grit Excluders made of PTFE shall be provided to prevent the entry of grit and solids into the bearing areas.

F. Pressure ratings shall be bi-directional and 175 psi on sizes 3-inch through 12-inch diameters and 150 psi for 14-inch through 36-inch diameters. Every valve shall be given a certified hydrostatic and seat test, with test reports being available upon request.

G. Worm gear actuators shall be provided on all valves six inches and larger. Actuators shall be enclosed in a cast iron housing, with outboard seals to protect the bearings and other internal components. The actuator shaft and gear quadrant shall be supported on permanently lubricated bronze bearings.

H. Buried actuators shall be 90 percent grease filled. Input shaft and fasteners shall be stainless steel. Actuator mounting brackets shall be totally enclosed.

I. Eccentric plug valves and actuators shall meet or exceed the latest revisions of AWWA C517 and other applicable standards. Flanged ends shall be per ANSI B16.1 and mechanical joint ends per AWWA C111.

2.14 BUTTERFLY VALVES (For Use In Reclaimed Water Systems Only)

A. Valve shall be designed, manufactured, and tested in accordance with AWWA C504, latest revision, and include the following design features. Valve shall be rated and tested for absolute, zero leakage shut-off.

B. Valve body shall be cast iron per ASTM A 126 Class B or ductile iron per ASTM A536 Grade 65-45-12. Flanged end valves shall be faced and drilled per ANSI B16.1, Class 125, or as specified by purchaser. Mechanical joint ends shall be per ANSI A21.11 and include mechanical joint end accessories. Valve body shall include a stainless steel seat ring that is mechanically retained without use of clamping devices, adjusting segments, or other hardware being in the waterway.

C. Valve disc shall be solid type ductile iron without any external vanes, ribs, etc., to obstruct flow. Resilient seat shall be located on edge of disc, offset from the shaft, and seal against mating stainless steel body seat with 36 degree uninterrupted contact. The resilient seal shall be locked to the disc by three separate means of retention, and be field-adjustable, if necessary, with no tools

other than a standard socket wrench. Replacement of seat in field shall be possible without valve disassembly. The disc shall be connected to the offset stainless steel shaft by locked taper wedge keys and stainless steel retaining nuts on the back side of the disc. Taper keys shall be heat treated 416 Stainless Steel for added strength. Shaft shall be stub type for valves 30inches and larger in diameter; one piece for valves 24 inches in diameter and smaller. The valve shall be equipped with adjustable thruster for centering the disc on valves 30 inches and larger in diameter, if required.

D. Shaft shall have nylon sleeve or woven Teflon fiberglass-backed sleeve for bearing surfaces. Bearings shall be self lubricating.

E. Valve body shall be primed with manufacturer's standard primer.

2.15 VALVE BOXES

A. All valve boxes shall be cast iron and shall conform to ASTM A48 and AWWA M44. Valve boxes shall be of the adjustable screw type (based on depth of burial) with a base to fit the valve yoke with a removable cover with the word "SEWER" cast thereon.

2.16 SEWAGE AIR/VACUUM RELEASE VALVES

A. Acceptable Products:

1. The air/vacuum release valve shall be designed specifically for use on sanitary sewer pressure (force) mains. It shall exhaust large volumes of air that may be present in a system during filling of the main or on pump start-up. It shall also allow air to re-enter when the system is drained intentionally or due to a break in the main (prevents vacuum from forming).

2. Three inch and smaller combination air valves with operating pressures of 150 psi or less shall be of the integral type with a valve assembly which functions as both an air and vacuum valve and an air release valve. The valves shall be DeZurik Apco/Hilton "Series 400", GA Industries "Figure 942", Crispin “Type SA", Val-Matic "Models 801A/802A/803A" or ARI “D-020”.

3. Four inch and larger combination air valves shall consist of an air and vacuum valve with an externally mounted air release valve. The valves shall be DeZurik Apco/Hilton "Series 400C", GA Industries "Figure 950 Kinetic Custom Combination Air Valves", Crispin “Type SL", or Val-Matic "Model No. 48A/49A".

B. Materials:

1. Except as modified or supplemented herein, materials of construction shall comply with the standards of the authorities having jurisdiction. The use of stressed thermoplastic components will not be acceptable.

a. Valve Trim: Bronze or austenitic stainless steel.
b. Float: Austenitic stainless steel.
c. Seats: Buna-N

C. Shop Coating and Painting:

1. All interior and exterior ferrous metal surfaces, except stainless steel components, shall be shop painted for corrosion protection. The valve manufacturer's standard coating will be acceptable. Field painting is covered in the protective coatings section.

D. Shutoff Valves:

1. A shutoff valve shall be provided in the piping leading to each air release valve and combination air valve. Each 4-inch and larger combination air valve shall be provided with a shutoff valve between the air and vacuum valve and the air release valve.

PART 3 - EXECUTION

3.1 BYPASS PUMPING

A. Under this item the Contractor is required to furnish all materials, labor, equipment, power, maintenance, etc. to implement a temporary pumping system for the purpose of diverting the existing flow around the work area for the duration of the project.

B. Field Quality Control and Maintenance:

1. Testing:

a. The Contractor shall perform leakage and pressure tests on the new bypass pumping discharge piping using clean water prior to actual operation. The Owner and Engineer shall be given 24-hours' notice prior to testing.
b. The bypass pumping system shall be tested and operated successfully for 24 continuous hours, and the wet well shall be emptied, prior to start of work.

2. Inspection:

a. The Contractor shall monitor the bypass pumping operation at all times to ensure that the system is working correctly.

3. Maintenance Service:

a. The Contractor shall insure that the temporary pumping system is properly maintained and a responsible operator shall be on-site when pumps are operating.
b. A factory-trained service technician shall be located within at least 120 miles from the project site with a full complement of in-stock spare parts for pumps and piping.

4. Extra Materials:

a. Spare parts for pumps and piping shall be kept on site as required.
b. Adequate hoisting equipment for each pump and accessories shall be maintained on the site.

C. Preparation:

1. Precautions:

a. The Contractor shall make all arrangements for bypass pumping during the time when the main is shut down for any reason. System must overcome any existing force main pressure on discharge.
b. Contractor is responsible for locating any existing utilities in the area the Contractor selects to locate the bypass pipelines. The Contractor shall locate the bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from the Owner. All costs associated with relocating utilities and obtaining all approvals shall be paid by the Contractor.
c. During all bypass pumping operation, the Contractor shall protect the Owner's pump station and/or sewer mains and all local sewer lines from damage inflicted by any equipment. The Contractor shall be responsible for all physical damage to the pumping station and main and all sewer lines caused by human or mechanical failure.

D. Performance Requirements:

1. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

2. The Contractor shall provide all necessary means to safely convey the incoming sewage past the work area. The Contractor will not be permitted to stop or impede the flows in existing force mains.

3. The Contractor shall maintain sewer flow around the work area in a manner that will not cause surcharging of sewers, damage to sewers and that will protect public and private property from damage and flooding. Any sanitary sewer overflow that occurs due to a failure in the bypass system will be the responsibility of the Contractor. Any penalties issued by authorities having jurisdiction will be reimbursed to the Owner by the Contractor.

4. The Contractor shall protect water resources, wetlands and other natural resources. No sewage or water from the bypass pumping operation shall be spilled on the ground or allowed to drain to storm drains. When disassembling bypass pumping pipe, the Contractor shall ensure that any sewage remaining in the pipe is drained back to the sewer collection system. All spills shall be reported to the Owner, contained and cleaned up immediately by the Contractor.

E. Installation and Removal:

1. The Contractor shall remove manhole sections or make connections to the existing sewer and construct temporary bypass pumping structures only at the access location indicated on the Drawings and as may be required to provide adequate suction conduit.

2. Plugging or blocking of sewage flows shall incorporate primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance or work, it is to be removed in a manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.

3. When working inside manholes or sewer lines, the Contractor shall comply with OSHA requirements when working in the presence of sewer gases, combustible oxygen-deficient atmospheres, and confined spaces.

4. The installation of the bypass pipelines is prohibited in all saltmarsh/wetland areas. The bypass pipeline must be located off streets and sidewalks and on shoulders of the roads. When the bypass pipeline crosses local streets and private driveways, the contractor must place the bypass pipelines in trenches and cover with temporary pavement. Upon completion of the bypass pumping operations, and after the receipt of written permission from the Owner, the Contractor shall remove all the piping, restore all property to pre-construction condition and restore all pavement. The Contractor is responsible for obtaining any approvals for placement of the temporary pipeline within public ways from authorities having jurisdiction.

5. If, at any time during construction, effluent from the existing sewer is not fully contained by the bypass system, gravity service will be restored by a temporary tie to the new construction and work will be suspended until the problem is resolved to the satisfaction of the Engineer.

3.2 EARTHWORK

A. Excavating, trenching, backfilling and compaction requirements are specified in Division 31 Section "Earth Moving."

3.3 PIPING AND VALVE APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications:

1. Do not use flanged pipe, fittings or valves or unions for underground (buried) piping. Fittings and valves for underground (buried) piping shall be mechanical joint.

2. Flanged pipe, fittings and valves and unions shall be used on aboveground piping and piping in vaults.

3. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used as specified, unless otherwise indicated.

3.4 PIPING INSTALLATION

A. Existing Utilities and Separation Requirements:

1. The Contractor shall be required to excavate to determine the precise location of utilities or other underground obstructions which are shown on the Plans and/or marked by the utility owners. Such location and excavation shall be at least 500 feet ahead of construction, unless otherwise noted. This work shall be done at no additional cost to the Owner.

2. All utility owners shall be notified prior to excavation as required by the 1985 Underground Damage Prevention Act. Utility owners who are members of NC OneCall may be notified by calling 811 (toll free) before any excavation or drilling. The Contractor will be fully responsible for damage to any utilities if the owners have not been properly notified as required by the Underground Damage Prevention Act. All damage to such structures and pipelines and all damage to property or persons resulting from damage to such structures and pipelines shall be borne by the

Contractor and shall be completely repaired within a reasonable time. No claim shall be made against the Owner for damage or delay of the work on account of the proximity of, or the leakage from, such structures and pipelines. Where high pressure gas lines are to be crossed, they shall be uncovered by hand excavation methods before other excavation near them is started.

3. Utility owners may, at their option, have representatives present to supervise excavation in the vicinity of their utilities. The cost of such supervision, if any, shall be borne by the Contractor.

4. Conflicts with underground utilities may necessitate changes in alignment and/or grade of this construction. All such changes will be approved by the Engineer before construction proceeds.

5. When underground obstructions not shown on the Plans are encountered, the Contractor shall promptly report the conflict to the Engineer and shall not proceed with construction until the conflict is resolved.

6. When a sewer main or lateral crosses an existing water main or other utility, the Contractor shall make the installation in accordance with the minimum specifications of the Controlling Agency and in accordance with the following minimum requirements. When a sewer main or lateral crosses or parallels an existing utility, the following clearance requirements are to be met or ferrous sewer pipe with water tight joints shall be used for a distance of 10 feet outside said point of crossing or until horizontal separation requirements are achieved.

    a. Min. Vertical Separation for Sewer Crossings:
        1) Storm Sewers - 24" Vertical
        2) Under Water - 18" Vertical
        3) Over Water - 18" Vertical * Sewer over water requires that both pipes shall be ferrous pipe with a 20 foot jointless span centered at crossing. *
        4) Cable - 24" Vertical
        5) Power - 24" Vertical
        6) Gas - 24" Vertical

    b. Horizontal Separations:
        1) Storm Sewers - 5'
        2) Water Mains - 10'
        3) Water Supply - 100' (WS-I Waters, Class I or Class II impounded reservoirs)
        4) Water Supply - 50' (WS-II, WS-III, B, SA, ORW, HQW or SB Waters – from Normal High Water)
        5) Designated Trout Streams - 25'
        6) Other Stream, Lake or Impoundment - 10'

7) Building Foundation - 5'
8) Basement - 10'
9) Ground Water Lowering and Surface Drainage Ditch 10’
10) Swimming Pool - 10'
11) Private Wells - 25'
12) Public Wells - 50'

B. Conventional Pipe Laying:

1. The layout of gravity sanitary sewer lines and invert elevations at governing points shall be as shown on the drawings.

2. The Contractor shall do all layout work for lines and grades from that information shown on the drawings or as furnished by the Engineer.

a. When a laser beam instrument is used to set line and grade, the unit must be maintained in good working order, and the calibration checked daily for both alignment and percent grade. In the event the required accuracy of alignment and grade is not adhered to, the Engineer will prohibit the use of laser beams.

b. Install piping beginning at low point, true to the grades and alignment indicated with unbroken continuity. Pipe shall be laid with bell ends facing in the direction of pipe laying, unless directed otherwise by the Engineer. In all cases, pipe is to be installed in strict accordance with the manufacturer's recommendations and the contract material specifications. The Engineer may augment any manufacturer's installation recommendations if, in his opinion, it will best serve the interest of the Owner.

c. Proper tools, implements, and facilities satisfactory to the Engineer shall be provided and used for the safe and convenient prosecution of pipe laying. All pipe and other materials used in the laying of pipe will be lowered into the trench piece by piece by means of suitable equipment in such a manner to prevent damage to the pipe, materials, to the protective coating on the pipe materials, and to provide a safe working condition to all personnel in the trench. Each piece of pipe being lowered into the trench shall be clean, sound and free from defects. It shall be laid on the prepared foundation, as specified elsewhere to produce a straight line on a uniform grade, each pipe being laid so as to form a smooth and straight inside flow line. Pipe shall be removed at any time if broken, injured or displaced in the process of laying same, or of backfilling the trench.

d. When cutting short lengths of pipe, a pipe cutter, as approved by the Engineer, will be used and care will be taken to make the cut at right angles to the centerline of the pipe or on the exact skew as shown

on the plans. In the case of push-on pipe, the cut ends shall be tapered with a portable grinder, or coarse file to match the manufactured taper.

e. Place a plug in the end of incomplete piping at end of day and when work stops. No trench water or other material shall be permitted to enter the pipe. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.

f. Where the pipe is laid on a grade of 20 percent or greater, the laying shall start at the bottom of the slope and proceed upward with the bell end of the new pipe upgrade. All pipe laid on a grade of 20 percent or greater shall require thrust blocking or keying as shown on the drawings and standard details.

g. Install ductile iron, gravity sewer piping in accordance with ASTM A 746.

h. Install PVC gravity sewer piping in accordance with ASTM D 2321 and ASTM F 1668.

i. Install reinforced-concrete sewer piping in accordance with ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

j. All sanitary sewer force main piping shall be installed with 36-inch minimum cover over the top of the pipe.

k. Install ductile iron force main piping in accordance with AWWA C600 or AWWA M41.

l. Install PVC force main piping in accordance with AWWA M23 or ASTM D 2774 and ASTM F 1668.

m. Install detectable warning tape over all nonferrous piping.

C. Exposed Piping:

1. All exposed piping to be installed inside wetwells, vaults and buildings shall be installed as shown on the Drawings and field painted as described below. All exposed pipe shall be ductile iron utilizing flanged joints unless otherwise noted.

2. All exposed ductile iron pipe, fittings and valves shall be field painted with two (2) coats of epoxy paint as recommended by the paint manufacturer. Color of paint shall be as selected by the Owner.

D. Horizontal Directional Drilling of HDPE Force Mains:

1. The Contractor may install HDPE force mains by means of horizontal directional drilling. The Contractor shall assemble, support, and pretest the pipeline prior to installation in the directional drill tunnel.

2. Horizontal directional drilling shall consist of the drilling of a small diameter pilot hole from one end of the alignment to the other, followed by enlarging the hole diameter for the pipeline insertion. The exact method and techniques for completing the directionally drilled installation will be determined by the Contractor, subject to the requirements of these specifications.

3. The Contractor shall prepare and submit a plan to the Engineer describing the insertion of the HDPE pipe into the opened bore hole. The plan shall include pullback procedure, ballasting, use of rollers, side booms and side rollers, coating protection, internal cleaning, internal gauging, hydrostatic tests, dewatering, and purging.

4. The required piping shall be assembled in a manner that does not obstruct adjacent roadways or public activities. The Contractor shall erect temporary fencing around the entry and exit pipe staging areas.

5. Each length of pipe shall be inspected and cleaned as necessary to be free of debris immediately prior to joining.

6. Pipes shall be joined to one another be means of thermal butt-fusion. Polyethylene pipe lengths to be joined by thermal butt-fusion shall be of the same type, grade, and class of polyethylene compound and supplied from the same raw material supplier.

7. Mechanical connections of the polyethylene pipe to auxiliary equipment shall be through flanged connections which shall consist of the following:

    a. A polyethylene “sub end” shall be thermally butt-fused to the ends of the pipe.

    b. Provide ASTM A240, Type 304 stainless steel backing flange, 125-pound, ANSI B16.1 standard, and gaskets as required by the manufacturer.

    c. Stainless steel bolts and nuts of sufficient length to show a minimum of three complete threads when the joint is made and tightened to the manufacturer’s standard. Retorque the nuts after 4 hours.

    d. Butt-fusion of pipes shall be performed in accordance with the manufacturer’s recommendation as to equipment and technique. Butt-fusion jointing shall be 100% efficient offering a joint weld strength equal to or greater than the tensile strength of the pipe.

8. Pipe installed by the directional drilled method must be located in plan as shown on the drawings, and must be no shallower than shown on the drawings unless otherwise approved. The Contractor shall plot the actual horizontal and vertical alignment of the pilot bore at intervals not exceeding 30 feet. The “as built” plan and profile shall be updated as the pilot bore is advanced. The Contractor shall at all times provide and maintain instrumentation that will accurately locate the pilot hole and measure drilling fluid flow and pressure. The Contractor shall grant the Engineer access to all data and readout pertaining to the position of the bore head and the fluid pressure and flows.

9. When requested, the Contractor shall provide explanations of this position monitoring and steering equipment. The Contractor shall employ experienced personnel to operate the directional drilling equipment and, in particular, the position monitoring and steering equipment. No information pertaining to the position or inclination of the pilot hole bores shall be withheld from the Engineer.

10. Each exit point shall be located as shown with an over-length tolerance of 10 feet for directional drills of 1,000 linear feet or less and 40 feet for directional drills of greater than 1,000 linear feet and an alignment tolerance of 5 feet left/right with due consideration of the position of the other exit points and the required permanent easement. The alignment of each pilot bore must be approved by the Engineer before pipe can be pulled. If the pilot bore fails to conform to the above tolerances, the Engineer may, at his option, require a new pilot boring to be made.

11. After the pipe is in place, cleaning pigs shall be used to remove residual water and debris. After the cleaning operation, the Contractor shall provide and run a sizing pig to check for anomalies in the form of buckles, dents, excessive out-of-roundness, and any other deformations. The sizing pig run shall be considered acceptable if the survey results indicate that there are no sharp anomalies (e.g. dents, buckles, gouges, and internal obstructions) greater than 2 percent of the nominal pipe diameter, or excessive ovality greater than 5 percent of the nominal pipe diameter. For gauging purposes, dent locations are those defined above which occur within a span of 5 feet or less. Pipe ovality shall be measured as the percent difference between the maximum and minimum pipe diameters. For gauging purposes, ovality locations are those defined above which exceed a span of 5 feet.

12. Reaming: Reaming operations shall be conducted to enlarge the pilot bore after acceptance of the pilot bore. The number and size of such reaming operations shall be conducted at the discretion of the Contractor.

13. Pulling Loads: The maximum allowable pull exerted on the HDPE pipelines shall be measured continuously and limited to the maximum

allowed by the pipe manufacturer so that the pipe or joints are not over stressed.

14. Torsion and Stresses: A swivel shall be used to connect the pipeline to the drill pipe to prevent torsional stresses from occurring in the pipe.

15. The lead end of the pipe shall be closed during the pullback operation.

16. Pipeline Support: The pipelines shall be adequately supported by rollers and side booms and monitored during installation so as to prevent over stressing or buckling during pullback operation. Such support/rollers shall be spaced at a maximum of 60 feet on centers, and the rollers to be comprised of a non-abrasive material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback. Surface damage shall be repaired by the Contractor before pulling operations resume.

17. The Contractor shall at all times handle the HDPE pipe in a manner that does not over stress the pipe. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50 percent of yield stress for flexural bending of the HDPE pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense. The Contractor shall take appropriate steps during pullback to ensure that the HDPE pipe will be installed without damage.

18. During drilling, reaming, or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits. To the greatest extent practical, these fluids must not be discharged into the waterway. When the Contractor's provisions for storage of the fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site. The Contractor shall conduct his directional drilling operation in such a manner that drilling fluids are not forced through the subbottom into the waterway. After completion of the directional drilling work, the entry and exit pit locations shall be restored to original conditions. The Contractor shall comply with all permit provisions.

19. Pits constructed at the entry or exit point area shall be so constructed to completely contain the drill fluid and prevent its escape to the beach or waterway.

20. The Contractor shall utilize drilling tools and procedures which will minimize the discharge of any drill fluids. The Contractor shall comply with all mitigation measures listed in the required permits and elsewhere in these specifications.

21. To the extent practical, the Contractor shall maintain a closed loop drilling fluid system.

22. The Contractor shall minimize drilling fluid disposal quantities by utilizing a drilling fluid cleaning system which allows the returned fluids to be reused.

23. As part of the installation plan specified herein before, the Contractor shall submit a drilling fluid plan which details types of drilling fluids, cleaning and recycling equipment, estimated flow rates, and procedures for minimizing drilling fluid escape.

24. All drilling operations shall be performed by supervisors and personnel experienced in horizontal directional drilling. All required support, including drilling tool suppliers, survey systems, mud cleaning, mud disposal, and other required support systems used during this operation shall be provided by the Contractor.

25. A smoothly drilled pilot hole shall follow the design of the pipe profile and alignment described on the construction drawings.

26. The position of the drill string shall be monitored by the Contractor with the downhole survey instruments. Contractor shall compute the position in the X, Y, and Z axis relative to ground surface from downhole survey data a minimum of once per length of each drilling pipe (approximately 31 foot interval). Deviations from the acceptable tolerances described in the specifications shall be documented and immediately brought to the attention of the Engineer for discussion and/or approval. The profile and alignment defined on the construction drawings for the bore holes define the minimum depth and radius of curvature. The Contractor shall maintain and provide to the Engineer, upon request, the data generated by the downhole survey tools in a form suitable for independent calculation of the pilot hole profile.

27. Between the water's edge and the entry or exit point the Contractor shall provide and use a separate steering system employing a ground survey grid system, such as "TRU-TRACKER" or equal wherever possible. The exit point shall fall within a rectangle 10 wide and 40 feet long centered on the planned exit point.

28. During the entire operation, waste and leftover drilling fluids from the pits and cuttings shall be dewatered and disposed of in accordance with all permits and regulatory agencies requirements. Remaining water shall be cleaned by Contractor to meet permit requirements.

29. Technical criteria for bentonite shall be as given in API Spec. 13A, Specification for Oil Well Drilling Fluids Material for fresh water drilling fluids. Any modification to the basic drilling fluid involving additives must describe the type of material to be used and be included on Contractor's

drilling plan presented to the Engineer. The Owner retains the right to sample and monitor the waste drilling mud, cuttings, and water.

30. The horizontal directional drilling operation is to be operated in a manner to eliminate the discharge of water, drilling mud and cuttings to the adjacent creek or land areas involved during the construction process. The Contractor shall provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste. All excavated pits used in the drilling operation shall be lined by Contractor with heavy-duty plastic sheeting with sealed joints to prevent the migration of drilling fluids and/or ground water.

31. The Contractor shall visit the site and must be aware of all structures and site limitations at the directional drill crossing and provide the Engineer with a drilling plan outlining procedures to prevent drilling fluid from adversely affecting the surrounding area.

32. The general work areas on the entry and exit sides of the crossing shall be enclosed by a berm to contain unplanned spills or discharge.

33. Waste cuttings and drilling mud shall be processed through a solids control plant comprised as a minimum of sumps, pumps, tanks, desalter/desander, centrifuges, material handlers, and haulers all in a quantity sufficient to perform the cleaning/separating operation without interference with the drilling program. The cuttings and excess drilling fluids shall be dewatered by the Contractor to the extent necessary for disposal in offsite landfills. Water from the dewatering process shall be treated by the Contractor to meet permit requirements and disposed of legally. The cuttings and water for disposal are subject to being sampled and tested. The construction site and adjacent areas will be checked frequently for signs of unplanned leaks or seeps.

34. Equipment (graders, shovels, etc.) and materials (such as groundsheets, hay bales, booms, and absorbent pads) for cleanup and contingencies shall be provided in sufficient quantities by the Contractor and maintained at all sites for use in the event of inadvertent leaks, seeps, or spills.

35. Waste drilling mud and cuttings shall be dewatered, dried, and stock piled such that it can be loaded by a front end loader, transferred to a truck and hauled offsite to a suitable legal disposal site. The maximum allowed water content of these solids is 50 percent of weight.

36. Due to a limited storage space at the worksites, dewatering and disposal work shall be concurrent with drilling operations. Treatment of water shall satisfy regulatory agencies before it is discharged.

3.5 MANHOLE INSTALLATION

A. Sanitary sewer manholes shall be installed at each change in line or grade in each gravity sanitary sewer line as shown on the contract drawings.

B. The manhole foundation shall be prepared so as to provide a firm, level area on which to place the precast concrete manhole base section. When poor foundation soil is encountered or excess groundwater exists, the foundation shall be excavated 12 inches or greater below the final subgrade elevation, as determined by the Engineer and backfilled with washed stone to provide a proper foundation.

C. The manhole sections shall be lifted from the side of the excavation to the bottom of the trench with equipment and support slings capable of safely handling the heavy concrete pieces without damaging them. The manhole shall be set plumb and adjusted to the final finished surface grade with brick or grade rings and non-shrink grout.

D. Thoroughly clean the bells and spigots of each manhole section to remove dirt and other foreign materials that may prevent sealing. Unroll the butyl sealant directly against the base of the spigot. Leave protective wrapper attached until sealant is entirely unrolled against spigot. Do not stretch. Overlap from side to side - not top to bottom.

E. Pipe openings shall be exactly aligned to that of the pipe entering and leaving the manhole. The gravity sanitary sewer pipe lines shall be placed in the manhole openings, properly aligned, and set to grade. Sanitary sewer shall be connected to the manholes using flexible manhole sleeves as described above.

F. For large diameter pipe where a flexible rubber sleeve is not available, the pipe line shall be sealed into the manhole using an expanding type or non-shrink type grout.

G. For manhole steps, refer to the precast manhole section above.

H. After the manhole has been set in its final position, set the manhole frames to the required elevation using no more than 12 inches of precast concrete grade rings, or bricks sealing all joints between cone, adjusting rings, and manhole frame. When grade rings or bricks are used, grout with non-shrink grout. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted so as to conform to the exact slope, crown and grade of the existing surrounding pavement. Manhole frames which are placed above final grade will have frames attached to manhole cone section by means of 5/8-inch diameter stainless steel anchors and washers. One anchor bolt shall be provided per hole. Seal pipe penetrations, including pipe crown, to provide a smooth, uniform finish using non-shrink grout.

I. After the placement of manhole frame and vacuum testing, perform the final finishing to the manhole interior by filling all chips or fractures greater than 1/2 inch in length, width or depth (1/8 inch deep in inverts) with non-shrink grout. Grout the interior joints between the precast concrete sections with non-shrink grout. Sharp edges or rough finishes shall be removed providing a smooth surface throughout the manhole. Clean the interior of the manhole, removing all dirt, spills, or other foreign matter.

3.6 CONNECTIONS TO EXISTING SEWER SYSTEMS

A. Connections to existing collection systems will be allowed when proper precautions are taken to protect the existing collection system.

B. If the proposed sewer does not begin at an existing manhole, a new manhole will be "cut in" at the required location and the existing pipe(s) repaired as specified. For extensions of the existing system, the new "cut in" manhole or the connection to the existing manhole will not be constructed until all other sewer construction has been completed and tested in compliance with these specifications.

C. Pipelines or manholes which contain silt, sedimentation, or other foreign material shall not be connected to any portion of the existing collection system. The Contractor shall, at his own expense, flush, or otherwise cause the line (and manholes) to be cleaned out without any discharge into the existing system.

D. Any connection with 18-inch and smaller pipe at an existing precast or cast-in place manhole will require the Contractor to core the necessary opening through the manhole wall and install a flexible manhole sleeve. Sleeve shall be as specified elsewhere. Connections to existing brick manholes do not require coring and an opening may be carefully hammered or sawed. Connections to existing manholes for pipe larger than 18 inches in diameter may be cored or sawed as approved by the Engineer.

E. The existing manhole bench and invert shall be constructed and/or repaired in compliance with these specifications.

3.7 INSTALLING NEW SEWER SERVICE LINES

A. For extensions of the existing sewer system, all buildable lots adjacent to the extension shall have a sewer service line provided. Additional service lines may be installed by the Contractor as directed and authorized by the Engineer.

B. In general, service lines shall be constructed from the public sewer to a point located at the edge of the public right-of-way or the sewer easement. Service lines shall consist of a 4-inch or 6-inch diameter pipe, as listed in the Bid

Schedule and/or shown on the Plans. Install a cleanout at the end of the service line at the public right-of-way.

C. Service lines built for vacant lots/future connections shall have a cleanout assembly constructed, which includes a 1 foot capped stub-out on the service line. The vertical cleanout pipe shall also be capped, and shall be a minimum of 3 feet above the finished grade.

D. The standard sewer service connection shall be 4 inches in diameter unless shown otherwise on the drawings, and shall connect to the main at a wye branch connection installed with the pipe line as it is being laid. Service lines 4 inches or less shall not be made into a manhole. Service connections 6 inches or greater shall only be made into an existing or proposed manhole, unless otherwise approved by the Engineer.

E. The Owner -maintained portion of each sewer service line shall have a minimum of 3 feet of cover, unless approved by the Engineer.

F. Sewer service lines and clean-outs shall be Class 350 DIP (with Class 350 appurtenances) if:

1. The service line installed will have less than 3 feet of cover; or

2. The service line crosses a creek or drainage ditch (whether aerial or subaqueous).

G. The minimum slope on any residential sewer service line shall not be less than 2 percent.

H. At the edge of the public or utility right-of-way, a "cleanout" shall be installed. The cleanout shall consist of a "wye" branch connection, 45-degree bend, riser pipe, and threaded plug installed flush with finished ground elevation. The end of the utility owner's sewer service connection shall terminate at the end of the pipe which will normally extend five feet beyond the "wye" branch for the cleanout. A watertight plug shall be installed at the end of this line until such time as the property owner connects their facilities to the sewer system. In addition, one cleanout shall be constructed for:

1. Every four 45-degree changes located in series (a long sweep is equivalent to two 45-degree bends); and

2. At intervals no greater than 100 feet.

I. When the depth of cut is over 8 feet and the grade of a sanitary sewer is lower than necessary to serve abutting property, and at such other locations as may be designated by the Engineer, the Contractor may install the service line with a 22 ½ or 45 degree bend just upstream of the cleanout assembly to bring the service line up to the necessary elevation.

J. Unless required service depth is noted on construction Plans, the Contractor shall contact the Engineer and request confirmation of grade prior to constructing any sewer service line at a depth greater than 8 feet.

3.8 REINSTATING EXISTING SEWER SERVICE LINES

A. Where existing sewer mains are being rehabilitated, sewer service lines shall be constructed for each property that is occupied by a business or dwelling if it is currently served by the system being rehabilitated.

B. The Contractor shall be responsible to locate and connect all existing sewer service lines to the new main. In the event a service is missed during construction, the Contractor shall return to the site and perform all work necessary to reinstate the connection. The Contractor will be compensated in accordance with the original contract unit pricing; however, re-mobilization to the site will not be paid for. In addition, the Contractor shall be responsible for any costs associated with a sanitary sewer overflow and associated damage to public or private property through the omission of reinstating an active sewer service.

C. Service lines 4 inches or less in diameter shall be tapped into the sewer main, not into a manhole. Service connections 6 inches or greater shall only be made into an existing or proposed manhole, unless otherwise approved by the Engineer.

3.9 ABANDONMENT OF EXISTING SEWERS AND MANHOLES

A. Manholes which are to be abandoned shall first have both influent and effluent lines plugged inside the manhole with watertight masonry or concrete. The manhole will then be filled with non-compressible material (crushed stone or materials approved by the Engineer), to a point not less than 3 feet below the finish grade. The remainder of the manhole shall be broken down and removed. Then the excavation shall be backfilled to finish grade as specified in Division 31 Section "Earth Moving".

B. Abandoned mains at active manholes shall be completely disconnected from the manhole by cutting the pipe outside the manhole and then plugging the abandoned main and the manhole wall with watertight masonry. The invert shall then be rebuilt to conform to these specifications.

C. Exposed sections of abandoned mains shall be removed to a point not less than 5 feet from the adjacent banks or surface waters. The remaining ends of the pipe shall be plugged with watertight masonry. Concrete piers or collars in the creek channel shall be removed completely. Concrete piers or collars not located in the creek channel shall be removed to a point 3 feet below the finish grade. Steel piers shall be cut off 3 feet below finish grade.

D. The minimum length of watertight masonry plugs will be the diameter of the abandoned pipe plus 1 foot.

3.10 FIELD QUALITY CONTROL

A. The Contractor shall maintain the project, insofar as his construction work is concerned, in first class condition for such time as is necessary to satisfy the Engineer that all installations are correct and acceptable.

B. Line Cleaning: Prior to inspection of any section(s) of gravity sanitary sewer pipe or force main the Contractor shall completely clean the lines of all debris, silt, etc. The pipe line shall be ready for use by the Owner and shall be proved to be in first class condition and constructed properly in accordance with the drawings and specifications.

C. The Contractor shall notify the Engineer that all or portions of the work are ready for testing. All testing shall be scheduled with the Engineer, who will coordinate with the Owner, and respond to the Contractor regarding a mutually available date and time for the necessary testing. All testing shall be done in the presence of the Engineer. All labor, equipment, water and other materials, including meters and gauges, shall be furnished by the Contractor at his own expense.

D. Inspection and Testing of Gravity Sewers:

1. Alignment and grade between manholes shall be tested by the Engineer by flashing a light between manholes. A full circle of light shall be seen when reviewed from the adjoining end of the line. All defects disclosed as a result of this test shall be corrected by the Contractor at his expense.

2. PVC pipe shall pass a go-no go mandrel sized to 95 percent of the pipe diameter (as defined in ASTM D-3034) with the pipe in place and properly backfilled. All pipe which will not pass the mandrel shall be relaid or replaced by the Contractor at no additional cost. The chart that follows indicates the required mandrel diameter for specific sizes of SDR 35 PVC piping. The allowable deflection (less than 5 percent) for other pipe sizes and types shall be calculated using the pipe stiffness formula in ASTM D 2321. The mandrel test shall not take place until the final backfill has been in place for a minimum of 30 days.

Nominal Pipe Size	Pipe I.D. (SDR 35)	Required Mandrel O.D.
8"	7.665"	7.28"
10"	9.563"	9.08"
12"	11.361"	10.79"
15"	13.898"	13.20"

3. The mandrel shall be pulled through each section of pipe from manhole to manhole. The mandrel must slide freely through the pipe with only a nominal hand force applied. No mechanical device shall be used in pulling the mandrel. Any pipe which refuses the mandrel shall be removed and replaced. Such sections shall be re-tested for deflection 30 days after completion of trench backfill.

4. Mandrel testing may be performed by the Owner at any time prior to the expiration of the one year warranty. Any pipe which refuses the mandrel shall be replaced by the Contractor as described above at no cost to the Owner.

5. When the sewers are completed they shall be inspected by the Engineer for conformance with the provisions of the plans and specifications, particularly line and grade. All visible and audible leaks will be repaired.

6. The infiltration into each section of the sewer shall be measured in wet weather by the temporary installation of suitable V-notch weir. This weir shall be furnished, installed and removed by the Contractor. Infiltration test limits shall be applied to single reaches of pipe, up to one mile in length, of the same diameter. For pipes 8 inches through 15 inches in diameter, infiltration into the sewer system (including manholes) shall not exceed 50 gallons per mile of sewer per inch of inside diameter of the sewer per 24 hours, and in no case shall it exceed 3,000 gallons per mile per 24 hours. For all pipe sizes larger than 15 inches in diameter, infiltration into the sewer system (including manholes) shall not exceed 100 gallons per mile of sewer per inch of inside diameter of the sewer per 24 hours, and in no case shall it exceed 3,000 gallons per mile per 24 hours.

7. If infiltration into the whole system or any segment thereof exceeds the requirements described above, necessary corrective measures shall be taken by the Contractor to limit the infiltration to the maximum specified above. The Engineer shall decide the number and length of segments of sewer line on which the testing shall be performed.

8. The Contractor shall furnish all facilities and personnel and conduct low pressure air tests on all completed sections of gravity sewer. Air tests for PVC and DIP lines shall be performed in accordance with ASTM C828. Air tests for concrete pipe 30 inches in diameter and smaller shall be performed in accordance with ASTM C924. Air tests will not be required on pipe with diameters exceeding 30 inches. Acceptance of pipes exceeding 30 inches will be based on infiltration tests and/or visual inspection of the joints.

9. The acceptance air test shall be made after backfilling has been completed and compacted and in the presence of the Engineer. For

ductile iron pipelines, test in accordance with the applicable requirements of ASTM C924. For PVC pipelines test in accordance with ASTM F1417-98.

10. The Contractor shall furnish an air compressor of the necessary capacity along with all necessary plugs, valves, pressure gages, air hoses, connections, and other equipment necessary to conduct the air tests. Plugs in sewers 18 inches in size and larger shall be connected by steel cable for thrust reaction.

11. Compressor capacity shall be sufficient to pressurize the sewer main to 4 PSIG within a time equal to or less than the required test time. The following equation may be used to insure compliance with this requirement:

$$C = \frac{0.17 \times D^2 \times L}{T} + Q$$

Where: C=Required Compressor Capacity (cfm)
T=Required Test Time (min)
D=Pipe Internal Diameter (feet)
L=Length of Test Section (feet)
Q=Allowable Air Loss Rate (cfm)

The following allowable air loss rates will be used for all pipe tests:

Pipe Size	Q (cfm)	Pipe Size	Q(cfm)
4”	2.0	15”	4.0
6”	2.0	18”	5.0
8”	2.0	21”	5.5
10”	2.5	24”	6.0
12”	3.0		

12. The sewer section shall be plugged at both ends and air pressure shall be applied until the pressure inside the pipe reaches 4 PSIG. When a stable condition has been reached, the pressure shall be bled back to 3.5 PSIG. At 3.5 PSIG, the time and pressure shall be observed and recorded. If groundwater is present at the sewer, the height of the groundwater above the top of the pipe shall be added to the above air pressure readings (height of water in feet X 0.433 = air pressure in psig). A minimum of five (5) readings will be required for each test.

13. If the time for the air pressure to decrease from 3.5 PSIG to 2.5 PSIG is equal to or greater than that shown in the following table, the pipe shall be presumed to be free from defect. When these times are not attained, pipe breakage, joint leakage, or leaking plugs are indicated and the cause must be determined and corrected. After repairs have been made, the sewer

sections shall be retested. This process shall be repeated until all sewer sections pass the air tests.

Pipe Diameter (inches)	Specification Time for Length Shown (Minutes : Seconds)							
	100ft	150ft	200ft	250ft	300ft	350ft	400ft	450ft
8	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	14:10	17:48	22:15	26:42	31:09	35:35	40:04
18	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33

14. For testing a sewer system with one or more installed service lateral pipes, an effective pipe length shall be added to the total sewer main pipe length. The equation used to calculate Effective Pipe Length is as follows:

$$L_e = \frac{d^2 \times l}{D^2}$$

Where: L_e=Effective Pipe Length (added to Total Test Length)
d=Diameter of Service Lateral Pipe
l=Length of Sewer Lateral
D=Diameter of Sewer Main Pipe being tested

15. Failure of any section of the pipeline to meet the requirements of this test shall cause the Contractor to determine, at his own expense, the source(s) of leakage, and repair or replace all defective materials or workmanship. The repaired section(s) of line shall be re-tested to insure conformance with the requirements of these contract specifications.

E. Inspection and Testing of Sewer Force Mains:

1. When the sanitary sewer force main is completed, the Engineer shall inspect the line for conformance with the provisions of the drawings and specifications, particularly with respect to alignment and depth. The minimum depth of all force mains shall be 36 inches unless otherwise specified.

2. All newly constructed sanitary sewer force main and valved sections shall be subjected to a hydrostatic pressure-leakage test. Hydrostatic testing shall be conducted only after thrust blocks, supports, and anchors have fully hardened. Force mains shall be tested in sections not to exceed

4,000 lineal feet per test section. The Contractor shall install sufficient additional valves if not shown on the drawings to allow for testing.

3. HDPE pipe shall be hydrostatically tested after joining into continuous lengths prior to installation and again after installation. Pressure and temperature shall be monitored with certified instruments during the test. After this test, the water will be removed with pigs. Erosion prevention procedures shall be used during removal and discharge of the water. Hydrostatic testing shall be performed in accordance with these specifications.

4. Each completed section of the pipeline shall be plugged at both ends and slowly filled with water. As the main is being filled with water in preparation of the test, all air shall be expelled from the pipe. The main shall be subjected to a hydrostatic pressure not less than 1-1/2 times the maximum system operating pressure or 100 pounds per square inch, whichever is greater, for a period of two hours unless otherwise specified. Pressure shall be applied to the main by means of a hand pump for small lines or by use of a gasoline pump or fire engine for larger lines.

5. The rate of leakage shall be determined at 15 minute intervals by means of volumetric measure of the water added during the test until the rate has stabilized at the constant value for three consecutive 15 minute periods.

6. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted until the leakage is less than ten (10) gallons per inch of pipe diameter per mile of pipe per 24 hours.

7. Cracked or defective pipe, joints, fittings, or valves discovered in consequence of this test shall be removed and replaced with sound materials, and the test shall be repeated until the test results are satisfactory. Precautions shall be taken to remove or otherwise protect equipment in, or attached to, pipe to prevent damage or injury thereto.

8. Tests of insulated and concealed piping shall be made before the piping is covered or concealed. No leakage will be allowed under the above tests for piping in buildings, structures or on bridges.

9. Ductile iron force main piping shall be tested in accordance with AWWA C600, while all PVC force main piping shall be tested in accordance with AWWA M23. HDPE force main piping shall be tested in accordance with ASTM F2164.

F. Inspection and Testing of Manholes:

1. Manholes shall be constructed to provide a true circular inside diameter with properly corbeled tops, satisfactory inverts and properly placed steps and castings. Any visible leaks in the manholes shall be completely stopped to the satisfaction of the Engineer.

2. All sanitary sewer manholes constructed by the Contractor shall be vacuum tested for leakage in the presence of the Engineer. Vacuum testing shall be performed in accordance with ASTM C1244. The vacuum test requirement will not apply to any existing manhole, or any existing manhole that has been converted to a drop manhole by the Contractor.

3. The Contractor shall furnish all labor, equipment, and any appurtenant items necessary to satisfactorily perform the vacuum test. All testing equipment shall be approved for vacuum testing manholes.

4. Vacuum Testing Procedure:

   a. Vacuum test the assembled manhole after completing pipe connections, sealing and allowing mortar or cement proper curing time. Plug pipes with suitably sized and rated pneumatic or mechanical pipe line plugs. Place plugs a minimum of 6 inches beyond the manhole wall and brace to prevent displacement of the plugs or pipes during testing.

   b. All lifting holes shall be plugged with an approved non-shrink grout inside and out. Manhole joints shall be grouted from the outside only. All pipes entering the manhole shall be plugged. The Contractor shall securely brace the plugs in order to keep them from being drawn into the manhole. The test head shall be placed at the inside of the top of the cone section of the manhole and the seal inflated in accordance with the manufacturer's recommendations.

   c. Position the vacuum tester head assembly according to the manufacturer's recommendations. Draw a vacuum of 10 inches of mercury, close the valve on the vacuum line and shut off the vacuum pump and measure the time for the vacuum to drop to 9 inches of mercury. The manhole shall pass when the time to drop to 9 inches of mercury meets or exceeds the table below:

Manhole Vacuum Testing Time (Seconds)			
Manhole Depth (Feet)	**Manhole Diameter (Inches)**		
	48	**60**	**72**
0-8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73

20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

d. If the manhole fails the test, remove the head assembly and coat the manhole interior with a soap and water solution and repeat the vacuum test for approximately 30 seconds. Leaking areas will have soapy bubbles. Make the necessary repairs and repeat the test until the manhole passes.

5. Vacuum testing is not required on manholes with pipe connections in excess of 30 inches in diameter.

G. Final Acceptance:

1. The Engineer will notify the Contractor, in writing, as to the satisfactory completion of the work in any or all sections of gravity sanitary sewer pipe, force main and manholes, included in the project.

2. Upon such notification, the Contractor shall immediately remove all construction equipment, excess materials, tools, debris, etc. from the site(s) and leave the same in a neat, orderly condition acceptable to the Engineer.

3. Final landscaping requirements and restoration of surfaces shall then be completed by the Contractor in accordance with their respective specification sections and as shown on the drawings.

END OF SECTION 332700

SECTION 334100 STORM DRAINAGE MATERIALS

GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Nonpressure transition couplings.
3. Pressure pipe couplings.
4. Expansion joints and deflection fittings.
5. Drains.
6. Encasement for piping.
7. Manholes.
8. Channel drainage systems.
9. Catch basins.
10. Stormwater inlets.
11. Stormwater detention structures.
12. Pipe outlets.
13. Stormwater disposal systems.

1.3 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials

B. CMP: Corrugated Metal Pipe.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High Density Polyethylene.

E. NCDOT: North Carolina Department of Transportation.

F. RCP: Reinforced Concrete Pipe.

1.4 SUBMITTALS

A. Shop Drawings: The Contractor shall submit at least six (6) copies of shop drawings to the Engineer, including dimensional drawings, materials of construction, catalogue cut sheets, and other pertinent information.

1.5 QUALITY ASSURANCE

A. All materials shall be manufactured by suppliers with at least five (5) years of experience in the manufacture of similar materials.

1.6 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered, stored and handled in strict accordance with the manufacturer's recommendations, and in a manner which preserves the structural integrity of the materials.

B. Do not store plastic materials in direct sunlight.

C. Protect pipe, pipe fittings, and seals from dirt and damage.

D. Handle concrete drainage structures according to manufacturer's written rigging instructions.

1.7 WARRANTY

A. All materials and equipment shall be warranted to be free from defects in workmanship and materials for one (1) year after Owner's acceptance.

1.8 PROJECT CONDITIONS

Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Engineer no fewer than three days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Engineer's written permission.

PART 2 - PRODUCTS

CORRUGATED STEEL PIPE AND FITTINGS

A. Corrugated-Steel Pipe and Fittings: AASHTO M-36, Type 2, except as modified by NCDOT 1032-3 corrugated steel with rerolled ends.

B. Pipe shall be furnished with manufacturer's "hugger type" coupling bands. The use of dimple bands will not be allowed.

C. All corrugated metal pipe shall have 2-2/3-inches by ½ inch corrugations.

D. Pipe 18-inches and smaller in diameter shall be 16 gauge.

E. Pipes 21-inches through 30-inches in diameter shall be 14 gauge.

F. Pipes 36-inches through 48-inches in diameter shall be 12 gauge.

G. Pipes 48-inches and larger in diameter shall be 10 gauge.

H. When shown on the drawings, pipes shall be furnished with full or partial bituminous coatings and/or paved in accordance with NCDOT 1032-4. Bituminous coatings, where required by the drawings, shall consist of asphalt cement having a minimum thickness of 0.04-inches measured at the crest of the corrugations. Paved inverts in corrugated metal pipe, where required by the drawings, shall consist of asphalt cement applied on the inside of the pipe for one quarter of its circumference (bottom of pipe when installed). The pavement shall have a minimum thickness of 0.50 inches tapering to 0.1 inches at the sides.

2.2 CORRUGATED ALUMIUM ALLOY PIPE AND FITTINGS

A. Corrugated-Steel Pipe and Fittings: AASHTO M196, Type 2,and NCDOT 1032-2 aluminized corrugated steel with rerolled ends.

B. Pipe shall be furnished with manufacturer's "hugger type" coupling bands. The use of dimple bands will not be allowed.

C. Pipes 24-inches and smaller in diameter shall be 16 gauge.

D. Pipes 30 inches through 42-inches in diameter shall be 14 gauge.

E. Pipes larger than 42-inches in diameter shall be 12 gauge.

2.3 HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

A. Corrugated HDPE Pipe and Fittings (12-inch to 60-inch): AASHTO M294, Type S, with smooth interior wall, with watertight joints.

B. Pipe and fittings shall be made of virgin polyethylene compounds that comply with the cell classification 435400C, as defined and described in ASTM D3350, except that carbon black content should not exceed 4%. The 12-inch through 24-inch virgin pipe material shall comply with the notched constant ligament-stress (NCLS) test as specified in Sections 9.5 of AASHTO M294.

2.4 CONCRETE PIPE AND FITTINGS

A. Reinforced Concrete Pipe: ASTM C-76, Class III, with Wall Type B, and AASHTO M170, except as modified by NCDOT 1032-9, paragraph B.

B. All pipe shall have interior surfaces free from roughness, projection, indentations, offset or irregularities of any kind.

C. Joint material for reinforced concrete pipe shall be either “O” ring type joints utilizing a rubber “O” ring, or bell and spigot type utilizing a mastic joint material as provided by the pipe manufacturer.

2.5 MANHOLES

A. Standard precast concrete manholes sections shall conform to the latest revision of ASTM C 478. Tapered section and transition sections, where required, shall be of eccentric cone design, having the same wall thickness and reinforcement as the cylindrical ring sections. Flat slab tops shall be required for very shallow manholes where shown or specified. Flat slab tops shall ONLY be utilized when/where approved for use by the Engineer. All manholes shall be constructed to the sizes, shapes and dimensions and at the locations shown on the plans. Unless otherwise shown on the plans, manhole diameters, wall thicknesses and bottom thicknesses shall be as follows:

Pipe Size (inches)	Diameter (feet)	Wall Thickness (inches)	Bottom Thickness (inches)
8 through 18	4	5	6
21 through 36	5	5	8
39 through 54	6	6	8
Larger than 54	8	8	8

B. The minimum wall thickness of all manhole riser sections shall be as shown in the table above. Cone sections shall have a minimum wall thickness of 8 inches at their top. Suitable openings for inlet and outlet pipes shall be cast into the base

section for standard connections and into the riser section for drop connections. These openings shall be circular, accurately located and appropriately sized for each manhole.

C. When indicated on the drawings, precast concrete base sections shall be provided with extended base sections or increased bottom thickness to provide ballast to prevent flotation. When necessary, this ballast shall be provided as shown on the drawings and incorporated into the manhole base section as a monolithic pour.

D. Minimum compressive strength of concrete shall be 4,000 psi at 28 days and shall comply with ACI 318, and ACI 350. The maximum permissible absorption shall be 6.0 percent. All cement used in the mixture shall be in accordance with ASTM C 150, Type II. Fine aggregate shall be sand, while coarse aggregate shall be crushed gravel, both in accordance with ASTM C 33. All water utilized in the concrete mix shall be potable water. Risers shall be reinforced with a single cage of steel placed within the center third of the wall. Welded wire fabric shall be in accordance with ASTM A 185. Steel reinforcing bars shall be grade 60 deformed steel in accordance with ASTM A 615. The tongue or the groove of the joint shall contain one (1) line of circumferential reinforcement equal in area to that in the barrel of the manhole riser. The minimum cross sectional area of steel per linear foot shall be 0.12 square inches. Precast manhole sections shall fit together readily.

E. The quality of materials, the process of manufacture, and the finished manhole sections shall be subject to inspection and approval by the Engineer and his Construction Field Representative. The manhole sections shall be perpendicular to their longitudinal axis within the limits listed in ASTM C 478.

F. Joint Sealing Materials: Joints shall be sealed by two (2) butyl rubber seals. Each seal shall be as described below:

1. Butyl Seals shall consist of a plastic or paper-backed butyl rubber rope no less than 1 inch cross section. When manholes are larger than 4 feet diameter or have a larger than normal space between the joints, the length and or diameter of the rope shall be increased as required to achieve a seal. Butyl rubber material shall conform to Federal Specification SS-S210A, AASHTO M-198, Type B - Butyl Rubber and as follows: maximum of 1 percent volatile matter and suitable for application temperatures between 10 and 100 degrees F. Butyl rubber shall be applied to clean, dry surfaces only. Use of 2 independent wraps of Butyl Rubber qualifies for the requirement of two seals.

2. Internal O-Ring Gaskets and Internal Rubber Gaskets shall not be used.

G. Manhole Steps

1. Steps shall be a copolymer polypropylene plastic reinforced with a ½ inch diameter, grade 60 bar and have serrated tread and tall end lugs. Step pull out strength shall be a minimum of 2,000 pounds when tested according to ASTM C-497.

2. Steps shall be required in all structures with a depth greater than four (4) feet. Steps shall be vertically aligned and uniformly spaced for the entire depth of the structure. Steps shall be located in the structures along the vertical face of the eccentric cone and so as to land upon a bench.

3. Steps shall be vertically spaced between twelve (12) and sixteen (16) inches on center. Step width shall be a minimum of twelve (12) inches. Steps shall protrude from the wall of the structure a minimum of five (5) inches and a maximum of seven (7).

4. Secure steps to the wall with a compression fit in tapered holes. Steps shall not be vibrated or driven into freshly cast concrete. Steps shall not be grouted in place.

H. Precast Grade Rings and Brick

1. Precast reinforced concrete grade rings or brick shall be used to adjust ring and covers to finished grade. No more than 12 vertical inches of grade rings or brick will be allowed per manhole. Grade rings shall conform to ASTM C478 and shall be no less than 6 inches and no more than 9 inches in height with a diameter matching that of the frame and cover.

2. All brick used shall be solid and shall be made from Concrete, Clay, or Shale, and shall be of standard building size.

2.6 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4,000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.

2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3,000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

2.7 PRECAST CONCRETE BOXES

A. All rectangular drainage structures shall meet the requirements of NCDOT Standard Specifications for Roads and Structures (latest edition) articles 840-1 through 840-3 as well as NCDOT Standard Detail 840.45. No waffle boxes shall be allowed. All pipe openings in precast structures must be cast or cored.

B. Curb inlet catch basins shall conform to NCDOT Standard Details 840.02 and 840.04.

C. Drop inlets shall conform to NCDOT Standard Detail 840.14.

D. Junction boxes shall conform to NCDOT Standard Detail 840.31

E. Manhole Steps

1. Steps shall be a copolymer polypropylene plastic reinforced with a ½ inch diameter, grade 60 bar and have serrated tread and tall end lugs. Step pull out strength shall be a minimum of 2,000 pounds when tested according to ASTM C-497.

2. Steps shall be required in all structures with a depth greater than four (4) feet. Steps shall be vertically aligned and uniformly spaced for the entire depth of the structure. Steps shall be located in the structures along the vertical face of the structure.

3. Steps shall be vertically spaced between twelve (12) and sixteen (16) inches on center. Step width shall be a minimum of twelve (12) inches. Steps shall protrude from the wall of the structure a minimum of five (5) inches and a maximum of seven (7).

4. Secure steps to the wall with a compression fit in tapered holes. Steps shall not be vibrated or driven into freshly cast concrete. Steps shall not be grouted in place.

F. Precast Grade Rings and Brick

1. Precast reinforced concrete grade rings or brick shall be used to adjust frames and covers to finished grade. No more than 12 vertical inches of grade rings or brick will be allowed per structure. Grade rings shall conform to ASTM C478 and shall be no less than 6 inches and no more than 9 inches in height with a diameter matching that of the frame and cover.

2. All brick used shall be solid and shall be made from Concrete, Clay, or Shale, and shall be of standard building size.

2.8 FRAMES, GRATES AND HOODS

A. All metal castings and grating shall meet the requirements of NCDOT Standard Specifications for Roads and Structures (latest edition) articles 1074-7 and 1074-9.

B. All metal castings shall be sound and free from warp, holes and other defects that impair their strength or appearance. Exposed surfaces shall have a smooth finish and sharp, well defined lines and arises. Machined joints, where required, shall be milled to a close fit. Provide all necessary lugs and brackets so that work can be assembled in a neat, substantial manner.

C. Frames, grates and hoods for curb inlets shall conform to NCDOT Standard Detail 840.03.

D. Frames and grates for drop inlets shall conform to NCDOT Standard Detail 840.16.

E. Frames and covers for junction boxes shall conform to NCDOT Standard Detail 840.54. Include indented top design with lettering cast into cover, using wording "STORM SEWER."

2.9 AGGREGATE FOR UNDERDRAINS

A. Aggregate for underdrains shall be washed stone, standard size number 67 per North Carolina Department of Transportation specifications, Section 1005.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PREPARATION OF PIPE FOUNDATION

A. Lines and Grades: The pipe foundation shall be prepared to be uniformly firm and shall be true to the lines and grades as shown on the plans. Any deviation or field adjustments will require the approval of the Engineer. When a Construction Field Representative is present on the site and is so requested by the Contractor, he shall check the position of grades and lines; but the Contractor shall be responsible for the finished drain line being laid to exact and proper line and grade.

B. Pipe Foundation:

1. Whenever the nature of the ground will permit, the excavation at the bottom of the trench shall have the shape and dimensions of the outside lower third of the circumference of the pipe, care being taken to secure a firm bearing support uniformly throughout the length of the pipe. A space shall be excavated under and around each bell to sufficient depth to relieve it of any load and to allow ample space for filling and finishing the joint. The pipe, when thus bedded firmly, shall be on the exact grade. In case the bed shaped in the bottom of the trench is too low, the pipe shall be completely removed from position, and earth of suitable quality shall be placed and thoroughly tamped to prepare a new foundation for the pipe.

2. In no case shall the pipe be brought to grade by blocking up under the barrel or bell of same, but a new and uniform support must be provided for the full length of the pipe. Where rock or boulders are encountered in the bottom of the trench, the same shall be removed to such depth that no part of the pipe, when laid to grade, will be closer to the rock or boulders than 6”. A suitably tamped and shaped foundation of suitable earth shall be placed to bring the bottom of the trench to proper subgrade over rock or boulders.

3. Where the foundation material is found to be of poor supporting value, the Engineer may make minor adjustment in the location of the pipe to provide a more suitable foundation. Where this is not practical, the foundation shall be conditioned by removing the existing foundation material by undercutting

to the depth as directed by the Engineer, within the limits established on the plans, and backfilling with either a suitable local material secured from unclassified excavation or borrow excavation at the nearest accessible location along the project, or foundation conditioning material consisting of crushed stone or gravel or a combination of sand and crushed stone or gravel approved by the Engineer as being suitable for the purpose intended. The selection of the type of backfill material to be used for foundation conditioning will be made by the Engineer.

C. Water in Trenches: The Contractor shall remove all water which may be encountered or which may accumulate in the trenches by pumping or bailing and no pipes shall be laid until the water has been removed from the trench. The Contractor will not be permitted to drain water through the storm drain within a period of 24 hours after the pipe has been laid, and the open end of the pipe in the trench shall be kept closed with a tight fitting plug to prevent washing of dirt or debris into the line. Water so removed from the trench must be disposed of in such manner as not to cause injury to work completed or in progress.

D. Special Foundations: Whenever the bottom of the trench shall be of such nature as to provide unsatisfactory foundation for the pipe, the Engineer will require the pipe to be laid on timber or concrete cradle foundations. Such foundations whether of single plank, plank cradle, plank cradle supported on piles, or poured concrete cradle, shall be placed by the Contractor and compensation will be allowed the Contractor for the materials so used.

3.3 PIPING INSTALLATION

A. General: All piping is to be installed in strict accordance with the manufacturer's recommendations. Installation manuals from various material suppliers shall be furnished to the Engineer for his review and approval prior to installation of any material. The Engineer may augment any manufacturer's installation recommendations, if in his opinion it will best serve the interest of the Owner.

B. Laying Pipe:

1. No pipe shall be laid except in the presence of the Engineer or his Construction Field Representative or without special permission from the Engineer. Proper tools, implements, and facilities satisfactory to the Engineer shall be provided and used for the safe and convenient prosecution of pipe laying. All pipe, fittings, valves, and other materials used in the laying of pipe will be lowered into the trench piece by piece by means of suitable equipment in such a manner to prevent damage to the pipe materials, to the protective coating on the pipe materials, and to provide a safe working condition to all personnel in the trench. Each piece of pipe being lowered into the trench shall be carefully given a final

inspection to see that it is clean, sound and free of defects. It shall be laid on the prepared foundation to produce a straight line on a uniform grade, each pipe being laid as to form a close abutted joint with a preceding pipe, so as to form a smooth and straight inside flow line. Each pipe will be tested for its exact position after it is in its final position. The pipes shall be fitted together in order to insure sufficient space for joint gaskets, and other jointing material. Pipe shall be removed at any time if broken, injured or displaced in the process of laying same, or of backfilling the trench.

2. When cutting short lengths of pipe, a pipe cutter as approved by the Engineer will be used, and care will be taken to make the cut at right angles to the center line of the pipe, or on the exact skew as shown on the plans. In the case of push on pipe, the cut ends shall be tapered with a portable grinder of coarse file to match the manufactured taper.

3. When coupling bands for annular or helical corrugated metal pipe are used, the pipe sections shall be joined and fully bolted so that the circumferential and longitudinal strength will be sufficient to preserve the alignment, prevent separation of the sections, and to prevent infiltration of backfill material.

3.4 CONCRETE STRUCTURE INSTALLATION

A. Drainage structures shall be built to the lines, grades and dimensions as shown on the plans. The Contractor shall adjust the final grades in the field as necessary to provide positive drainage to the structures or to match final pavement or grade elevation.

B. Excavations for drainage structures shall be made with care so as not to disturb the surrounding areas more than necessary. All excavations shall be maintained water free until completion of the drainage structure, including backfilling. The Contractor shall provide adequate pumping capacity as required.

C. Where the foundation material is found to be of poor supporting value, the existing foundation material shall be removed by undercutting to the depth directed by the Engineer and backfilled with suitable material secured from locations along the project or from a borrow pit. The backfill placed in the undercut area shall be compacted to a degree satisfactory to the Engineer.

D. Precast concrete sections shall be lifted from the side of the excavation to the bottom of the trench with equipment and support slings capable of safely handling the weight of the concrete pieces. The structure shall be set plumb and adjusted to the final finished surface grade with brick and mortar.

E. For cast-in-place structures the Contractor shall use care in placing rebar and concrete. Unless otherwise approved, the bottom slabs shall be poured separate from the walls. A minimum of seven (7) days cure time shall be provided between completion of pouring the bottom and the walls.

F. Pipe openings shall be exactly aligned to that of the pipe(s) entering and/or leaving the structure. The pipe lines shall be placed in the structure openings, properly aligned, and set to grade.

G. When existing drainage structures are constructed of concrete brick, only new, sound brick shall be used to modify those structures. Mortar mix shall be mixed on site using an approved mortar mix consisting of Portland Cement (Type S), and clean sand. Following the modification of existing drainage boxes, both the interior and exterior shall be plastered with a minimum ½-inch thick coat of Portland Cement and sand mixture.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.6 FITTINGS AND CONNECTIONS

A. Where fittings enter masonry, they shall be placed as the work is built up, thoroughly bonded, and accurately spaced and aligned.

B. Pipe connections shall be cut off flush with the inside wall of the drainage structure and grouted as necessary to make smooth and uniform surfaces on the inside of the structure.

C. Metal frames for grates and covers shall be set in full mortar beds or secured by methods approved by the Engineer.

D. Pipe collars and pipe plugs shall be constructed in accordance with the details shown on the plans or as directed by the Engineer.

3.7 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch thick, concrete bulkheads.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.

2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 36 inches of top with CABC. Fill to top with compacted earth fill.

C. Backfill to grade according to Division 31 Section "Earth Moving."

3.8 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Upon completion, installed lines shall show a full circle of light when "Lamped" between drainage structures. This test shall be performed by the Engineer.

B. Other tests may be required by the Engineer, such as exfiltration. In this event the results shall meet the minimum standards that the manufacturer states are obtainable.

C. The Contractor shall demonstrate to the Owner and Engineer that all drainage structures operate as intended and designed. All drainage structures shall be field tested by the Contractor in the presence of the Engineer prior to final acceptance.

D. Replace defective piping and structures using new materials, and repeat inspections until defects are within allowances specified.

E. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

3.9 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 334100

APPENDICES

CONSTRUCTION DOCUMENTATION SET

NEW OPERATORS BUILDING FOR

CATAWBA COUNTY LANDFILL

AUGUST 25, 2026

MASTERS ARCHITECTURE PLLC

524 NORTH GRIFFING BLVD, ASHEVILLE, NC 28804

NOTICE:
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MASTERS ARCHITECTURE PLLC — PROFESSIONAL DESIGN ARCHITECTURAL CORPORATION — CERT. NO. 53428 — NORTH CAROLINA — ASHEVILLE, NC

MARK ALEXANDER MASTERS — REGISTERED ARCHITECT — 17193 — NORTH CAROLINA — ASHEVILLE, NC

THIS DRAWING SHALL NOT BE USED FOR THE PURPOSE OF CONSTRUCTION UNLESS THE PROJECT ARCHITECT'S SEAL AND CORPORATION SEAL APPEARS ABOVE ALONG WITH ITS CORRESPONDING SIGNATURE AND DATE.

2018 APPENDIX B BUILDING CODE SUMMARY

FOR ALL COMMERCIAL PROJECTS (EXCEPT 1 AND 2-FAMILY DWELLINGS AND TOWNHOUSES)

Name of Project: NEW OPERATORS BUILDING FOR CATAWBA COUNTY LANDFILL
Address: 4017 ROCKY FORD RD. NEWTON NC 28658 Zip Code: 28658
Proposed Use: Business
Owner/Authorized Agent: Rodney Hamby Phone: (828)465-5540 Email: RHAMBY@catawbacountync.gov

Owned By: ■ City/County ☐ Private ☐ State
Code Enforcement Jurisdiction: ☐ City ■ County ☐ State

CONTACT:

DESIGNER	FIRM	NAME	LICENSE #	PHONE	EMAIL
Architectural	Masters Architecture	Mark A. Masters	7193	(828) 768 - 6897	mark@masters-arch.com
Civil	McGill Associates, P.A.			(828) 252-0575	
Electrical	McGill Associates, P.A.	Nicholas C. Huffman	039548	(828) 252-0575	nick.huffman@mcgillassociates.com
Fire Alarm	McGill Associates, P.A.				
Plumbing	McGill Associates, P.A.			(828) 252-0575	
Mechanical	McGill Associates, P.A.			(828) 252-0575	
Sprinkler					
Structural	Medlock & Assoc. Engineering	Ed Medlock		(828) 232-4440	ems@medlockengr.com
Retaining Walls					
Other					

("Other" should include firms and individuals such as trues, precast, pre-engineered, interior designers, etc.)

2018 NC BUILDING CODE: ■ New Building ☐ Addition ☐ Shell/Core ☐ Phased Construction - Shell Core ☐ 1st Time Interior Completions

2018 NC EXISTING BUILDING CODE: ☐ Prescriptive ☐ Repair ☐ Chapter 14 ☐ Alteration Level I (Ren.) ☐ Alteration Level II (Alt.) ☐ Alteration Level III (Recon.) ☐ Historic Property ☐ Change of Use

CONSTRUCTED: RENOVATED: CURRENT OCCUPANCY(S) (EX. 3): PROPOSED OCCUPANCY(S) (EX. 3):

OCCUPANCY CATEGORY (Table 1604.5II): Current: Proposed:

BASIC BUILDING DATA

CONSTRUCTION TYPE: (check all that apply) ☐ I-A ☐ I-B ■ II-A ☐ II-B ☐ III-A ☐ III-B ☐ IV ☐ V-A ☐ V-B
Sprinklers: ■ No ☐ Yes ☐ Partial NFPA 13 ☐ NFPA 13R ☐ NFPA 13D
Standpipes: ■ No ☐ Class ☐ I ☐ II ☐ III Wet ☐ Dry
Primary Fire District: ■ No ☐ Yes Flood Hazard Area: ☐ No ☐ Yes
Special Inspections Required: ■ No ☐ Yes

GROSS BUILDING AREA TABLE

FLOOR	EXISTING (SQ FT)	NEW (SQ FT)	SUB-TOTAL
6th Floor			
5th Floor			
4th Floor			
3rd Floor			
Mezzanine			
2nd Floor			
1st Floor		2020	2020
Basement			
TOTAL	0	2020	2020

ALLOWABLE AREA

PRIMARY OCCUPANCY CLASSIFICATION(S):
Assembly ☐ A1 ☐ A2 ☐ A3 ☐ A4 ☐ A5
Business ■
Educational ☐
Factory ☐ F-1 Moderate ☐ F-2 Low
Hazardous ☐ H-1 Detonate ☐ H-2 Deflagrate ☐ H-3 Combust ☐ H-4 Health ☐ H-5 HPM
Institutional ☐ I-1 ☐ I-2 ☐ I-3 ☐ I-4
I-1 Condition ☐ 1 ☐ 2
I-2 Condition ☐ 1 ☐ 2
I-3 Condition ☐ 1 ☐ 2
Mercantile ☐
Residential ☐ R-1 ☐ R-2 ☐ R-3 ☐ R-4
Storage ☐ S-1 Moderate ☐ S-2 Low ☐ High-piled ☐ Repair Garage
Parking Garage ☐ Open ☐ Enclosed
Utility and Miscellaneous ☐

Accessory Occupancy Classification(s):
Incidental Uses (Table 509):
This separation is not exempt as a Non-Separated Use (see exceptions).
Special Uses (Chapter 4 - List Code Sections):
Special Provisions (Chapter 5 - List Code Sections):
Mixed Occupancy: (select one) Separation: Exception:
Select One:
Actual Area of Occupancy A + Actual Area of Occupancy B _ < 1
Allowable Area of Occupancy A Allowable Area of Occupancy B
+ _ + _ = _ < 1.00

Story No.	Description & Use	(A) BLDG Area Per Story (actual)	(B) Table 506.2 (4) Area	(C) Area for Frontage Increase (1,5)	(D) Allow. Area Per Story or Unlimited (2,3)

1. Frontage area increases from Section 506.2 are computed thus:
a. Perimeter which fronts a public way or open space having 20 feet min. width,= (F)
b. Total Building Perimeter = (P)
c. Ratio (F/P) = (F/P)
d. W = minimum width of public way = (W)
2. Unlimited area applicable under conditions of Section 507.
3. Maximum Building Area = total number of stories in the building x D (max. three stories) (506.2)
4. The maximum area of open parking garages must comply with Table 406.5.4. The maximum area of air
traffic
control towers must comply with Table 412.3.1.
5. Frontage increase is based on the unsprinklered area value in Table 506.2.

ALLOWABLE HEIGHT

	Allowable	Shown on Plans	Code Reference
Building Height in Feet (Table 504.3):	40	25'-8"	
Building Height in Stories (Table 504.4):	2	1	

(Provide code reference if the "Shown on Plans" quantity is not based on Table 504.3 or 504.4.)

FIRE PROTECTION REQUIREMENTS

Building Element	Fire Separation Distance (Feet)	Req'd	Rating Provided (with Reduction)	Detail # and Sheet #	Design # for Rated Assembly	Sheet # for Rated Penetration	Sheet # for Rated Joints
Structural Frame (inc. columns, girders, trusses)		0					
Bearing Walls		0					
Exterior		0					
North	10'	0					
East	>30'	0					
West	>30'	0					
South	>30'	0					
Interior		0					
Nonbearing Walls and Partitions		0					
Exterior Walls		0					
North		0					
East		0					
West		0					
South		0					
Interior Walls and Partitions		0					
Floor Construction (inc. supporting beams, joists)		0					
Floor Ceiling Assembly		0					
Columns Supporting Floors		0					
Roof Construction (inc. supporting beams, joists)		0					
Roof Ceiling Assembly		0					
Columns Supporting		0					
Roof		0					
Shaft Enclosures (exit)		0					
Shaft Enclosures (other)		0					
Corridor Separation		0					
Occupancy/Fire Barrier Separation		0					
Party/Fire Wall Separation		0					
Smoke Barrier Separation		0					
Smoke Partition		0					
Tenant/Dwelling Unit/Sleeping Unit Separation		0					
Incidental Use Separation		1					

(Indicate section number permitting reduction)

PERCENTAGE OF WALL OPENING CALCULATIONS

Fire Separation Distance (Feet) from Property Lines	Degree of Openings Protection (Table 705.8)	Allowable Area	Actual Shown on Plans (%)

NOT APPLICABLE

LIFE SAFETY REQUIREMENTS

Emergency Lighting:	■ Yes	☐ No
Exit Signs:	■ Yes	☐ No
Fire Alarm:	☐ Yes	■ No
Smoke Detection Systems:	☐ Yes	■ No
Carbon Monoxide Detection:	☐ Yes	■ No

LIFE SAFETY PLAN REQUIREMENTS

Life Safety Plan Sheet #: LS1.0

Fire and/or smoke rated wall locations (Chapter 7)
Assumed and real property line locations (if not on the site plan)
Exterior wall opening area with respect to distance to assumed property lines (705.8)
Occupancy Use for each area as it relates to occupant load calculation (Table 1004.1.2)
Occupant loads for each area
Exit access travel distances (1017)
Common path of travel distances (Tables 1006.2.1 & 1006.3.2(1))
Dead end lengths (1020.4)
Clear exit widths for each exit door
Maximum calculated occupant load capacity each exit door can accommodate based on egress width (1005.3)
Total occupant load for each exit door
A separate schematic plan indicating where fire rated floor/ceiling and/or roof structure is provided for purposes of occupancy separation
Location of doors with panic hardware (1010.1.10)
Location of doors with electromagnetic egress locks (1010.1.9.9)
Location of doors equipped with hold-open devices
Location of emergency escape windows (1030)
The square footage of each fire area (202)
The square footage of each smoke compartment for Occupancy Classification I-2 (407.5)
Note any code exceptions or table notes that may have been utilized regarding the items above

ACCESSIBLE DWELLING UNITS (SECTION 1107)

Total Units	Accessible Units Required	Accessible Units Provided	Type A Units Required	Type A Units Provided	Type B Units Required	Type B Units Provided	Total Access. Units Provided

NOT APPLICABLE

ACCESSIBLE PARKING (SECTION 1106)

Lot or Parking Area	Total # of Parking Spaces		# of Accessible Spaces Provided				Total # Accessible Provided
	Required	Provided	Regular w/ 8' Access Aisle	Van Spaces With 132" Access Aisle	Van Spaces With 8' Access Aisle		
NEW	7	7	0	0	1		1

PLUMBING FIXTURE REQUIREMENTS (TABLE 2902.1)

Use		Waterclosets			Urinals	Lavatories			Showers/ Tubs	Drinking Fountains	
		Male	Female	Unisex		Male	Female	Unisex		Regular	Accessible
Space	Exist.										
	New	2	1		1	2	1				
	Req'd	1	1			1	1				

SPECIAL APPROVALS

SPECIAL APPROVAL: (Local Jurisdiction, Department of Insurance, OSC, DPI, DHHS, etc., describe below)

ENERGY SUMMARY

ENERGY REQUIREMENTS:
The following data shall be considered minimum and any special attribute required to meet the energy code shall also be provided. Each designer shall furnish the required portions of the project information for the plan data sheet. If performance method, state the annual energy cost for the standard reference design vs annual energy cost for the proposed design.

Existing building envelope complies with code:
Exempt Building (provide code or statutory reference):
Method of compliance (if 'other' specify source here): Prescriptive

THERMAL ENVELOPE (Prescriptive method only)

Roof/Ceiling Assembly (each assembly)
Description of assembly: A - Metal panel, underlayment, decking, vented attic space, R-49 Kraft faced insulation, gypsum board, B - 5" R-38 Insulated metal panel
U-Value of total assembly: A - 0.0466, B - 0.027
R-Value of insulation: A - 49, B - 38
Skylights in each assembly: N/A
U-value of skylight: N/A
Total square footage of skylights in each assembly: N/A

Exterior Walls (each assembly): A - 4" CMU/Metal Panel, air gap, R7.5 1.5" XPS CI, sheathing, 4" metal studs w/ R-19 batt, 5/8" gypsum board
B - R-24 3" insulated metal panel, 7/8" horiz. hat channels & 4'-0" O.C., 4" metal studs, 5/8" gypsum board
U-Value of total assembly: N/A
R-Value of insulation:
Openings (windows or doors with glazing):
U-Value of assembly: Maximum U-factor for windows: 0.38, Maximum U-factor for doors: 0.77
Solar heat gain coefficient: Maximum SHGC for windows: 0.38, Maximum U-factor for doors: 0.38
Projection factor: N/A
Door R-Values: N/A

Walls Below Grade (each assembly)
Description of assembly: N/A
U-Value of total assembly:
R-Value of insulation:

Floors Over Unconditioned Space (each assembly)
Description of assembly: N/A
U-Value of total assembly:
R-Value of insulation:

Floors Slab on Grade
Description of assembly: 4" concrete slab on grade
U-Value of total assembly:
R-Value of insulation:
Horizontal/vertical requirement: R-10
Slab heated: No

STRUCTURAL DESIGN (PROVIDE ON SHEET 1 OR 2 OF THE STRUCTURAL SHEETS)

DESIGN LOADS:
Importance Factors: Wind: (Iw) Snow: (Is) Seismic: (Ie)
Live Loads: Roof: psf Mezzanine: psf Floor: psf
Ground Snow Load: psf
Wind Load: Basic Wind Speed: mph (ASCE 7) Exposure Category: A B C D
SEE S001
SEISMIC DESIGN CATEGORY: A B C D
Provide the following Seismic Design Parameters:
Occupancy Category (Table 1604.5): I II III IV
Spectral Response Acceleration: Ss Sds Sd1 Sd1
Site Class (Table 20.3-1 ASCE 7): A B C D E F
Data Source: Field Test Presumptive Historical Data
Basic Structural System
Bearing Wall Dual w/ Special Moment Frame
Building Frame Dual w/ Intermediate R/C or Special Steel
Moment Frame Inverted Pyndulum
Analysis Procedure Simplified Equivalent Lateral Force Dynamic
Architectural, Mechanical, Components anchored? Yes No

LATERAL DESIGN CONTROL: Earthquake Wind

SOIL BEARING CAPACITIES:
Field Test (provide copy of test report): psf
Presumptive Bearing capacity: psf
Pile size, type, and capacity: psf

MECHANICAL DESIGN (PROVIDE ON THE MECHANICAL SHEETS IF APPLICABLE)

MECHANICAL SUMMARY

MECHANICAL SYSTEMS, SERVICE SYSTEMS & EQUIPMENT

Thermal Zone
winter dry bulb:
summer dry bulb:
Interior Design Conditions:
winter dry bulb:
summer dry bulb:
relative humidity:
SEE M001
Building Heating Load:
Building Cooling Load:
Mechanical Spacing Conditioning System:
Unitary
description of unit:
cooling efficiency:
heating efficiency:
size category of unit:
Boiler
size category (if oversized, state reason):
Chiller
size category (if oversized, state reason):
List equipment efficiencies:

ELECTRICAL DESIGN (PROVIDE ON THE ELECTRICAL SHEETS IF APPLICABLE)

ELECTRICAL SUMMARY

ELECTRICAL SYSTEMS & EQUIPMENT

Method of Compliance:

Lighting Schedule (each fixture type)
lamp type required in fixture:
number of lamps in fixture:
ballast type used in fixture:
number of ballasts in fixture:
total wattage per fixture:
total interior wattage specified vs. allowed (whole building or space by space):
total exterior wattage specified vs. allowed:
SEE E001
Additional Prescriptive Compliance
☐ 506.2.1 More Efficient Mechanical Equipment
☐ 506.2.2 Reduced Lighting Power Density
☐ 506.2.3 Energy Recovery Ventilation Systems
☐ 506.2.4 Higher Efficiency Service Water Heating
☐ 506.2.5 On-Site Supply of Renewable Energy
☐ 506.2.6 Automatic Daylighting Control Systems

DRAWING INDEX

SHEET NUMBER	SHEET NAME
GENERAL	
G000	COVER SHEET
G001	GENERAL NOTES
G002	EROSION CONTROL NOTES
CIVIL	
C001	EXISTING CONDITIONS AND DEMOLITION PLAN
C100	SITE PLAN
C200	GRADING, DRAINAGE & EROSION CONTROL PLAN
C300	UTILITY PLAN
C500	DETAILS
C501	DETAILS
STRUCTURAL	
S001	APPENDIX 'B' & GENERAL STRUCTURAL NOTES
S002	TYPICAL LIGHT GUAGE FRAMING DETAILS
S101	FOUNDATION & ROOF FRAMING PLANS
S201	FOUNDATION SECTIONS & DETAILS
S301	ROOF SECTIONS & DETAILS
ARCHITECTURAL SITE	
AS101	ARCHITECTURAL SITE PLAN
ARCHITECTURAL	
A100	LIFE SAFETY PLAN
A101	NEW FLOOR PLAN & FINISH PLAN
A110	REFLECTED CEILING PLAN & ROOF PLAN
A201	EXTERIOR ELEVATIONS
A210	INTERIOR ELEVATIONS
A301	BUILDING SECTIONS
A310	WALL SECTIONS & DETAILS
A401	WINDOW SCHEDULES & DETAILS
A402	DOOR SCHEDULES & DETAILS
A501	DETAILS

SHEET NUMBER	SHEET NAME
PLUMBING	
P001	PLUMBING LEGEND
P101	PLUMBING FLOOR PLANS
P501	PLUMBING DETAILS
P601	PLUMBING SCHEDULES
MECHANICAL	
M001	HVAC TITLE SHEET
M101	MECHANICAL PLAN
M201	MECHANICAL DETAILS
ELECTRICAL	
E001	GENERAL ELECTRICAL INFORMATION
E101	ELECTRICAL SITE PLAN
E201	POWER AND LIGHTING PLANS
E501	ELECTRICAL DETAILS
E601	ELECTRICAL ONE-LINES AND SCHEDULES

CONSULTANTS

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828.252.0575

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53 ASHELAND AVENUE
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LOCATION MAP



GENERAL SITE/CIVIL NOTES

1. CONTRACTOR SHALL REPAIR ALL DISTURBED AREAS TO EQUAL OR BETTER CONDITION THAN THE ORIGINAL SITE, OR AS NOTED.
2. LOCATIONS OF EXISTING UTILITIES AS SHOWN ARE APPROXIMATE ONLY. EXACT LOCATIONS ARE TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR. AT LEAST THREE DAYS PRIOR TO CONSTRUCTION CONTRACTOR MUST NOTIFY EXISTING UTILITY OWNERS. CALL BEFORE YOU DIG, NORTH CAROLINA ONE CALL (1-800-632-4949).
3. THE CONTRACTOR WILL BE HELD RESPONSIBLE FOR ALL DAMAGE CAUSED BY HIS OPERATIONS TO EXISTING UTILITIES AND FACILITIES WHICH ARE NOT INCLUDED AS PART OF THE INTENDED WORK. DAMAGED UTILITIES AND FACILITIES SHALL BE REPAIRED OR REPLACED BY THE CONTRACTOR, TO THE SATISFACTION OF THE OWNERS' REPRESENTATIVE, AT NO ADDITIONAL COST TO THE OWNER.
4. THE CONTRACTOR SHALL COORDINATE HIS CONSTRUCTION OPERATIONS WITH ANY AND ALL OTHER CONSTRUCTION ACTIVITIES WHICH MAY BE OCCURRING SIMULTANEOUSLY ON THE SITE. LACK OF COORDINATION ON THE CONTRACTOR'S PART RESULTING IN EXTRA WORK OR SCHEDULE DELAYS SHALL NOT CONSTITUTE A CHANGE ORDER.
5. ALL WORK NEAR AND AROUND WATERWAYS MUST CONFORM TO THE RULES OF THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY, DIVISION OF ENERGY, MINERAL, AND LAND RESOURCES.
6. THE CONTRACTOR SHALL BE RESPONSIBLE AT NO ADDITIONAL COST TO THE OWNER, FOR MAINTENANCE OF ALL EROSION CONTROL MEASURES UNTIL SUCH TIME AS THE APPROPRIATE STATE, COUNTY, OR MUNICIPAL AUTHORITY RELEASES THE SITE AT WHICH TIME THE CONTRACTOR SHALL REMOVE ALL TEMPORARY EROSION CONTROL MEASURES AS DIRECTED BY THE ENGINEER.
7. CONSTRUCTION AND MAINTENANCE OF ALL EROSION CONTROL MEASURES SHALL BE IN ACCORDANCE WITH THE CORRESPONDING SECTIONS OF THE NORTH CAROLINA EROSION AND SEDIMENTATION CONTROL PLANNING AND DESIGN MANUAL, LATEST EDITION AND THE APPROVED EROSION AND SEDIMENTATION CONTROL PLAN.
8. CONTRACTOR SHALL FOLLOW ALL FEDERAL, STATE, AND LOCAL REGULATIONS PERTAINING TO CONSTRUCTION OPERATIONS.
9. CONTRACTOR SHALL NOTIFY THE PROPER LOCAL AUTHORITIES 24 HOURS PRIOR TO ANY ROAD BEING CLOSED FOR CONSTRUCTION, INCLUDING BUT NOT LIMITED TO THE LOCAL NEWSPAPER, RADIO STATION, FIRE DEPARTMENT, COUNTY SHERIFF'S DEPARTMENT, AMBULANCE, AND THE COUNTY EMERGENCY MANAGEMENT AGENCY. ALL TRAFFIC CONTROL SHALL CONFORM TO THE REQUIREMENTS OF THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION.
10. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO EXISTING ROADS DURING CONSTRUCTION AND SHALL REPAIR ROADS PER REQUIREMENTS OF THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION. NO OPEN CUTS OF EXISTING ROADS SHALL BE ALLOWED EXCEPT WHERE INDICATED ON THE DRAWINGS OR WHERE SPECIFIC PERMISSION IS GRANTED BY THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION. SAND OR A SIMILAR MATERIAL APPROVED BY THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION SHALL BE PLACED AS A PROTECTIVE BARRIER BETWEEN TRACK EQUIPMENT AND THE ROAD AND CLEANED UP PROPERLY AFTER CONSTRUCTION.
11. CONTRACTOR MAY BE REQUIRED TO PLACE TEMPORARY GROUNDCOVER DURING CONSTRUCTION OF THE BUILDING, WALKS, PAVING, ETC., HOWEVER THE GENERAL CONTRACTOR WILL BE REQUIRED TO PROVIDE 95% COVER OF PERMANENT SEEDING MIXTURE IN ALL AREAS. THE GENERAL CONTRACTOR WILL BE RESPONSIBLE FOR MAINTENANCE OF THE SEEDED AREAS UNTIL 95% GROUNDCOVER IS ESTABLISHED AND IS ACCEPTED BY THE OWNER AND THE ENGINEER.
12. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS PERTINENT TO THE WORK OF THIS CONTRACT IN THE FIELD. SIGNIFICANT DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
13. THE CONTRACTOR IS RESPONSIBLE FOR CONSTRUCTION STAKING/LAYOUT AND THE COST THERE OF SHALL BE INCLUDED IN HIS BID.
14. THE CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES THE CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR THE JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING THE SAFETY OF ALL PERSONS AND PROPERTY. THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO THE NORMAL WORKING HOURS. THE CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD OWNER AND ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXEMPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER OR THE ENGINEER.
15. THE CONTRACT DRAWINGS AND SPECIFICATIONS REPRESENT THE FINISHED STRUCTURE AND DO NOT INDICATE THE METHOD OF CONSTRUCTION. THE CONTRACTOR SHALL SUPERVISE AND DIRECT THE WORK AND SHALL BE SOLELY RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES AND PROCEDURES, INCLUDING, BUT NOT LIMITED TO BRACING AND SHORING. OBSERVATION VISITS TO THE SITE BY THE ENGINEER AND/OR THE ENGINEER'S REPRESENTATIVE(S) SHALL NOT INCLUDE INSPECTION OF THE PROTECTIVE MEASURES OR THE CONSTRUCTION PROCEDURES.
16. CONTRACTOR SHALL OBTAIN AND PAY FOR ALL PERMITS AND LICENSES NECESSARY TO ACCOMPLISH THE WORK PRIOR TO BEGINNING ANY WORK.
17. ALL SOIL EROSION CONTROL MEASURES REQUIRED BY THE GRADING PLAN SHALL BE PERFORMED PRIOR TO GRADING, CLEARING OR GRUBBING. ALL EROSION CONTROL DEVICES SUCH AS SILT FENCES, ETC., SHALL BE MAINTAINED IN WORKABLE CONDITION FOR THE LIFE OF THE PROJECT AND SHALL BE REMOVED AT THE COMPLETION OF THE PROJECT ONLY OR THE ENGINEER'S APPROVAL PAYMENT SHALL BE CONSIDERED INCIDENTAL TO CLEARING AND GRUBBING. IF DURING THE LIFE OF THE PROJECT, A STORM CAUSES SOIL EROSION WHICH CHANGES FINISH GRADES OR CREATES "GULLIES" AND "WASHED AREAS", THESE SHALL BE REPAIRED AT NO EXTRA COST, AND ALL SILT WASHED OFF OF THE PROJECT SITE ONTO ADJACENT PROPERTY SHALL BE REMOVED AS DIRECTED BY THE ENGINEER AT NO EXTRA COST. THE CONTRACTOR SHALL ADHERE TO ANY APPROVED EROSION CONTROL PLANS WHETHER INDICATED IN THE CONSTRUCTION PLANS OR UNDER SEPARATE COVER
18. THE CONTRACTOR SHALL CONTROL ALL "DUST" BY PERIODIC WATERING AND SHALL PROVIDE ACCESS AT ALL TIMES FOR PROPERTY OWNERS WITHIN THE PROJECT AREA AND FOR EMERGENCY VEHICLES. ALL OPEN DITCHES AND HAZARDOUS AREAS SHALL BE CLEARLY MARKED IN ACCORDANCE WITH THE SPECIFICATIONS.
19. ALL AREAS WHERE THERE IS EXPOSED DIRT SHALL BE SEEDED, FERTILIZED AND MULCHED ACCORDING TO THE SPECIFICATIONS. THE FINISHED SURFACE SHALL BE TO GRADE AND SMOOTH, FREE OF ALL ROCKS LARGER THAN 3", EQUIPMENT TRACKS, DIRT CLODS, BUMPS, RIDGES AND GOUGES PRIOR TO SEEDING; THE SURFACE SHALL BE LOOSENED TO A DEPTH OF ±4"-6" TO ACCEPT SEED. THE CONTRACTOR SHALL NOT PROCEED WITH SEEDING OPERATIONS WITHOUT FIRST OBTAINING THE ENGINEER'S APPROVAL OF THE GRADED SURFACE. ALL SEEDING SHALL BE PERFORMED BY A MECHANICAL "HYDRO-SEEDER". HAND SEEDING SHALL BE AUTHORIZED ON AN AREA BY AREA APPROVAL BY THE ENGINEER. DISTURBED AREAS SHOULD THEN BE MATTED WITH SHORT-TERM PHOTODEGRADABLE EROSION CONTROL MATTING.
20. WHERE SPECIFIED, STORM DRAIN PIPE SHALL BE CLASS III REINFORCED CONCRETE PIPE (RCP) CONFORMING TO AASHTO M-170, AS CONTAINED IN NCDOT STANDARD SPECIFICATION 1032-9 FOR WALL TYPE. WHERE SPECIFIED, ALL STORM DRAIN PIPE SHALL BE HIGH DENSITY POLYETHYLENE (HDPE), SMOOTH WALL INTERIOR, WITH WATER TIGHT JOINTS, BACKFILLED WITH # 57 WASHED STONE UP TO MIN. 6" OVER THE TOP OF THE PIPE. HDPE PIPE USED FOR STORM DRAINAGE DETENTION SYSTEMS SHALL BE ADS N12 WT OR APPROVED EQUAL.
21. CONTRACTOR SHALL VERIFY ALL ELEVATIONS BEFORE INSTALLATION OF FACILITIES.
22. TOPS OF PROPOSED FRAMES AND GRATES SHALL BE FLUSH WITH FINISHED GRADE.

GENERAL GRADING AND DRAINAGE CONSTRUCTION NOTES

1. FINISH GRADE TOLERANCES SHALL BE AS NOTED IN THE SPECIFICATIONS. THE ENGINEER MAY MAKE GRADE CHANGES AS REQUIRED IN THE FIELD WITHOUT AFFECTING THE BID PRICE FOR UNCLASSIFIED EXCAVATION.
2. UNLESS OTHERWISE STATED BY THE GEOTECHNICAL ENGINEER, ALL FILL AREAS SHALL BE CONSTRUCTED IN LAYERS OF 8" MAXIMUM THICKNESS WITH WATER ADDED OR SOIL CONDITIONED TO THE OPTIMUM MOISTURE CONTENT AS DETERMINED BY THE GEOTECHNICAL ENGINEER AND COMPACTED WITH A SHEEP'S FOOT ROLLER TO A COMPACTION EQUAL TO OR GREATER THEN 95 % (100% IN THE TOP 2' OF THE SUB GRADE BELOW ROADWAYS AND PARKING LOTS) OF THE DENSITY OBTAINED BY COMPACTING A SAMPLE OF THE MATERIAL IN ACCORDANCE WITH THE STANDARD PROCTOR METHOD OF MOISTURE-DENSITY RELATIONSHIP TEST, ASTM D698 OR AASHTO-99 UNLESS SPECIFIED IN OTHER SPECIFICATIONS.
3. ENTIRE AREA TO BE GRADED SHALL BE CLEARED AND GRUBBED. NO FILL SHALL BE PLACED ON ANY AREA NOT CLEARED OR GRUBBED.
4. PERIMETER SOIL EROSION CONTROL MEASURES REQUIRED BY THIS PLAN SHALL BE INSTALLED PRIOR TO GRADING, CLEARING OR GRUBBING. ALL EROSION CONTROL DEVICES SUCH AS SILT FENCES, ETC., SHALL BE MAINTAINED IN WORKABLE CONDITION FOR THE LIFE OF THE PROJECT AND SHALL BE REMOVED AT THE COMPLETION OF THE PROJECT ONLY OR THE ENGINEER'S APPROVAL PAYMENT SHALL BE CONSIDERED INCIDENTAL TO CLEARING AND GRUBBING. IF DURING THE LIFE OF THE PROJECT, A STORM CAUSES SOIL EROSION WHICH CHANGES FINISH GRADES OR CREATES "GULLIES" AND "WASHED AREAS", THESE SHALL BE REPAIRED AT NO EXTRA COST, AND ALL SILT WASHED OFF OF THE PROJECT SITE ONTO ADJACENT PROPERTY SHALL BE REMOVED AS DIRECTED BY THE ENGINEER AT NO EXTRA COST. THE CONTRACTOR SHALL ADHERE TO ANY APPROVED EROSION CONTROL PLANS WHETHER INDICATED IN THE CONSTRUCTION PLANS OR UNDER SEPARATE COVER.
5. DISPOSABLE MATERIAL
   - 5.1. CLEARING AND GRUBBING WASTES SHALL BE REMOVED FROM THE SITE AND PROPERLY DISPOSED OF BY THE CONTRACTOR AT HIS EXPENSE, UNLESS SPECIFIED OTHERWISE.
   - 5.2. ABANDONED UTILITIES SUCH AS CULVERTS, WATER PIPE, HYDRANTS, CASTINGS, PIPE APPURTENANCES, UTILITY POLES, ETC., SHALL BE THE PROPERTY OF THE SPECIFIED UTILITY AGENCY, OR COMPANY HAVING JURISDICTION. BEFORE THE CONTRACTOR CAN REMOVE, DESTROY, SALVAGE, REUSE, SELL OR STORE FOR HIS OWN USE ANY ABANDONED UTILITY, HE MUST PRESENT TO THE OWNER WRITTEN PERMISSION FROM THE UTILITY INVOLVED.
6. IN THE EVENT EXCESSIVE GROUNDWATER OR SPRINGS ARE ENCOUNTERED WITHIN THE LIMITS OF CONSTRUCTION, THE CONTRACTOR SHALL INSTALL NECESSARY UNDER DRAINS AND STONE AS DIRECTED BY THE GEOTECHNICAL ENGINEER, ALL WORK SHALL BE PAID BASED UPON BIDS UNLESS SPECIFIED OTHERWISE.
7. THE CONTRACTOR IS RESPONSIBLE FOR THE COORDINATION AND ADJUSTMENT OF ALL UTILITY SURFACE ACCESSES WHETHER HE PERFORMS THE WORK OR A UTILITY COMPANY PERFORMS THE WORK.
8. THE CONTRACTOR SHALL CONTROL ALL "DUST" BY PERIODIC WATERING AND SHALL PROVIDE ACCESS AT ALL TIMES FOR EMERGENCY VEHICLES. ALL OPEN DITCHES AND HAZARDOUS AREAS SHALL BE CLEARLY MARKED IN ACCORDANCE WITH THE SPECIFICATIONS.
9. ALL DISTURBED AREAS WHERE THERE IS EXPOSED SOIL SHALL BE SEEDED, FERTILIZED AND MULCHED ACCORDING TO THE SPECIFICATIONS. THE FINISHED SURFACE SHALL BE TO GRADE AND SMOOTH, FREE OF ALL ROCKS LARGER THAN 3", EQUIPMENT TRACKS, DIRT CLODS, BUMPS, RIDGES AND GOUGES PRIOR TO SEEDING. THE SURFACE SHALL BE LOOSENED TO A DEPTH OF ±4"-6" TO ACCEPT SEED. THE CONTRACTOR SHALL NOT PROCEED WITH SEEDING OPERATIONS WITHOUT FIRST OBTAINING THE ENGINEER'S APPROVAL OF THE GRADED SURFACE. ALL SEEDING SHALL BE PERFORMED BY A MECHANICAL "HYDRO-SEEDER". HAND SEEDING SHALL BE AUTHORIZED ON AN AREA BY AREA APPROVAL BY THE ENGINEER.
10. CONTRACTOR SHALL EXERCISE CARE, ESPECIALLY AT INTERSECTIONS AND DITCHES, TO PROVIDE POSITIVE DRAINAGE. ANY AREAS WHERE WATER IS IMPOUNDED AS A RESULT OF THIS CONSTRUCTION SHALL BE CORRECTED BY CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER. POSITIVE DRAINAGE OF ALL ROADWAY AREAS TO THE STORM DRAIN INLETS OR OTHER ACCEPTABLE DRAINAGE CHANNELS SHALL BE MAINTAINED AT ALL TIMES.
11. CONTRACTOR SHALL MAINTAIN EXISTING STREAMS, DITCHES, DRAINAGE STRUCTURES, CULVERTS AND FLOWS AT ALL TIMES DURING THE WORK. CONTRACTOR SHALL PAY FOR ALL PERSONAL INJURY AND PROPERTY DAMAGE WHICH MAY OCCUR AS A RESULT OF FAILING TO MAINTAIN ADEQUATE DRAINAGE.
12. ALL PIPES, DRAINAGE INLETS AND OTHER STRUCTURES UNCOVERED DURING CONSTRUCTION SHALL BE INSPECTED BY THE ENGINEER BEFORE BEING BACKFILLED OR BURIED. THE ENGINEER MAY REQUIRE CONTRACTOR, AT NO ADDITIONAL COST TO THE OWNER, TO UNCOVER AND RE-COVER SUCH STRUCTURES IF THEY HAVE BEEN BACKFILLED OR BURIED WITHOUT SUCH INSPECTION.

GENERAL DEMOLITION NOTES

1. ALL APPLICABLE EROSION CONTROL BEST MANAGEMENT PRACTICES (BMPS) SHALL BE INSTALLED PRIOR TO INITIATION OF DEMOLITION.
2. THE CONTRACTOR IS RESPONSIBLE FOR THE DEMOLITION, REMOVAL, AND DISPOSAL IN A LOCATION APPROVED BY ALL GOVERNING AUTHORITIES, OF ALL EXISTING STRUCTURES, ABOVE AND BELOW GRADE (E.G. PAVEMENT, DRAINAGE, UTILITIES, ETC.), SUCH THAT THE PROPOSED IMPROVEMENTS SHOWN WITHIN THESE PLANS CAN BE CONSTRUCTED. ALL EXISTING STRUCTURES TO BE REMOVED SHALL BE UNDERCUT TO SUITABLE MATERIAL AND BROUGHT TO GRADE WITH SUITABLE COMPACTED FILL MATERIAL PER THE SPECIFICATIONS.
3. THE CONTRACTOR IS RESPONSIBLE FOR REMOVING AND DISPOSING OF ALL DEBRIS FROM THE SITE IN A LAWFUL MANNER. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL PERMITS REQUIRED FOR DEMOLITION AND DISPOSAL.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DISCONNECTION OF UTILITY SERVICES TO ANY EXISTING STRUCTURES PRIOR THEIR DEMOLITION. ALL EXISTING SERVICES TO REMAIN SHALL BE PROTECTED DURING CONSTRUCTION ACTIVITIES AND REPLACED OR REPAIRED BY THE CONTRACTOR IF DAMAGED.
5. THE LOCATIONS OF ALL EXISTING UTILITIES SHOWN ON THIS PLAN HAVE BEEN DETERMINED FROM THE BEST INFORMATION AVAILABLE AND ARE GIVEN FOR THE CONVENIENCE OF THE CONTRACTOR. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR THEIR ACCURACY. PRIOR TO THE START OF ANY DEMOLITION ACTIVITY, THE CONTRACTOR SHALL NOTIFY THE UTILITY COMPANIES FOR CONFIRMATION OF ONSITE LOCATIONS OF EXISTING UTILITIES.
6. ALL EXISTING SEWERS, PIPING AND UTILITIES SHOWN ARE NOT TO BE INTERPRETED AS THE EXACT LOCATION, OR AS THE ONLY OBSTACLES THAT MAY OCCUR ON THE SITE. VERIFY EXISTING CONDITIONS AND PROCEED WITH CAUTION AROUND ANY ANTICIPATED FEATURES. GIVE NOTICE TO ALL UTILITY COMPANIES REGARDING DESTRUCTION AND REMOVAL OF ALL SERVICE LINES AND CAP ALL LINES BEFORE PROCEEDING WITH THE WORK.
7. ELECTRICAL, TELEPHONE, CABLE, WATER, FIBER OPTIC CABLE AND/OR GAS LINES REQUIRING REMOVAL OR RELOCATION SHALL BE COORDINATED WITH THE AFFECTED UTILITY COMPANY. ADEQUATE TIME SHALL BE PROVIDED FOR RELOCATION AND CLOSE COORDINATION WITH THE UTILITY COMPANY IS NECESSARY TO PROVIDE A SMOOTH TRANSITION IN UTILITY SERVICE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY FEES REQUIRED BY THE AFFECTED UTILITY COMPANY. CONTRACTOR SHALL PAY CLOSE ATTENTION TO EXISTING UTILITIES WITHIN ANY ROAD RIGHT OF WAY DURING CONSTRUCTION.
8. CONTRACTOR MUST PROTECT THE PUBLIC AT ALL TIMES BY PROVIDING FENCING, BARRICADES, ENCLOSURES, ETC., PER THE SPECIFICATIONS AND INDUSTRY ACCEPTED BMPS.
9. IF ACTIVITIES FOR REMOVAL AND/OR RELOCATION DAMAGE EXISTING FACILITIES WHICH ARE TO REMAIN, THEN THE CONTRACTOR SHALL PROVIDE NEW MATERIALS/STRUCTURES IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, AT NO EXTRA COST TO THE OWNER. ALL CONSTRUCTION MATERIALS SHALL BE NEW, UNLESS OTHERWISE NOTED.
10. CONTRACTOR SHALL LIMIT SAW-CUT & PAVEMENT REMOVAL TO ONLY THOSE AREAS WHERE IT IS REQUIRED. IF ANY DAMAGE IS INCURRED ON ANY OF THE SURROUNDING PAVEMENT OR STRUCTURES, THE CONTRACTOR SHALL BE RESPONSIBLE FOR IT'S REMOVAL AND REPAIR.
11. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING/EXECUTING ANY REQUIRED UTILITY MAIN SHUT OFFS WITH THE CITY/COUNTY/UTILITY PROVIDER DURING CONSTRUCTION. ANY COSTS ASSOCIATED WITH UTILITY MAIN SHUT OFFS WILL BE THE RESPONSIBILITY OF THE CONTRACTOR AND NO EXTRA COMPENSATION WILL BE PROVIDED.
12. DISPOSABLE MATERIAL
   - A. CLEARING AND GRUBBING WASTES SHALL BE REMOVED FROM THE SITE AND PROPERLY DISPOSED OF BY THE CONTRACTOR AT HIS EXPENSE, UNLESS SPECIFIED OTHERWISE. TOPSOIL MAY BE PLACED UP TO 6" IN DEPTH ON SLOPES AND OPEN AREAS IF AVAILABLE WITH PRIOR APPROVAL BY ENGINEER.
   - B. SOLID WASTES TO BE REMOVED, SUCH AS SIDEWALKS, CURBS, PAVEMENT, ETC., MAY BE PLACED IN SPECIFIC DISPOSAL AREAS DELINEATED ON THE PLANS OR REMOVED FROM THE SITE AS REQUIRED BY THE SPECIFICATIONS. THIS MATERIAL SHALL HAVE A MINIMUM COVER OF 2'. THE CONTRACTOR SHALL MAINTAIN SPECIFIED COMPACTION REQUIREMENTS IN THESE AREAS. WHEN DISPOSAL SITES ARE NOT PROVIDED, THE CONTRACTOR SHALL REMOVE THIS WASTE FROM THE SITE AND PROPERLY DISPOSE OF IT AT HIS EXPENSE.
   - C. ABANDONED UTILITIES SUCH AS CULVERTS, WATER PIPE, HYDRANTS, CASTINGS, PIPE APPURTENANCES, UTILITY POLES, ETC., SHALL BE THE PROPERTY OF THE SPECIFIC UTILITY AGENCY, OR COMPANY HAVING JURISDICTION. BEFORE THE CONTRACTOR CAN REMOVE, DESTROY, SALVAGE, REUSE, SELL OR STORE FOR HIS OWN USE ANY ABANDONED UTILITY, HE MUST PRESENT TO THE OWNER WRITTEN PERMISSION FROM THE UTILITY INVOLVED.

LEGEND – EXISTING CONDITIONS

TEL PED.	TELEPHONE PEDESTAL
	ELECTRIC PEDESTAL
	CABLE TV PEDESTAL
	SIGN
	UNDERGROUND CABLE TV SIGN
	UNDERGROUND FIBER OPTIC CABLE SIGN
UG TEL	UNDERGROUND TELEPHONE CABLE SIGN
	UNDERGROUND GAS LINE SIGN
	UNDERGROUND ELECTRIC SIGN
	INTERSTATE HIGHWAY
	U.S. HIGHWAY
	CONCRETE MONUMENT
	RIGHT-OF-WAY MONUMENT
DOT MON	D.O.T. CONTROL POINT
MB	MAILBOX OR PAPER BOX
PB	POSTAL DROP BOX
	LIGHT POLE
PP	UTILITY POLE
	GUY WIRE ANCHOR
	MONITORING WELL
	PIEZOMETER
MH	MANHOLE
	SANITARY SEWER MANHOLE
	STORM DRAIN MANHOLE
TPMH	TELEPHONE MANHOLE
	FIBER OPTIC MANHOLE
	ELECTRICAL MANHOLE
	JUNCTION BOX
SPIGOT	SPIGOT/YARD HYDRANT
C.O.	SEWER CLEAN-OUT
E.SS	ELECTRIC SERVICE STUB-OUT
G.SS	GAS SERVICE STUB-OUT
CB	CATCH BASIN
	WATER METER
	FIRE HYDRANT
	WATER VALVE
	GAS METER
	GAS VALVE
	IRRIGATION CONTROL VALVE
	POST INDICATOR VALVE
E.CAB	ELECTRIC CABINET
	ELECTRIC JUNCTION BOX OR OUTLET
	E.TRANS= ELECTRIC TRANSFORMER
RBF	IRON PIPE/PIN FOUND (PROPERTY CORNER)
PK NL	PK NAIL FOUND / SET
SPINDLE	PK NAIL FOUND / SET
CP/NL	CONTROL POINT/NAIL SET
CP/NL GPS	CONTROL POINT/NAIL SET GPS
	CULVERT
X X X	FENCE
	GUARD RAIL
SS SS	APPROXIMATE LOCATION OF EXISTING SEWER LINES
W W	APPROXIMATE LOCATION OF EXISTING WATER LINES
G G	APPROXIMATE LOCATION OF EXISTING GAS LINES
	TOP & TOE LINES
DL DL DL	DITCH LINES
	APPROXIMATE LOCATION OF UNDERGROUND CABLE TV LINE
	APPROXIMATE LOCATION OF OVERHEAD CABLE TV LINE
	APPROXIMATE LOCATION OF UNDERGROUND FIBER OPTIC CABLE LINE
E E	APPROXIMATE LOCATION OF UNDERGROUND ELECTRIC LINE
OHE OHE	APPROXIMATE LOCATION OF OVERHEAD ELECTRIC LINE
T T	APPROXIMATE LOCATION OF UNDERGROUND TELEPHONE LINES
T T	APPROXIMATE LOCATION OF OVERHEAD TELEPHONE LINES
ROW	RIGHT-OF-WAY
	CULTIVATED FIELD LINE
	TREES/SHRUBS
	TREELINE
IPS	IRON PIN SET
RBF	REBAR FOUND
OTIPF	OPEN TOP IRON PIN FOUND
CTIPF	CRIMPED TOP IRON PIN FOUND
CMU	CONCRETE MASONRY UNIT
R/W	RIGHT OF WAY
℄	CENTERLINE
C	CURVE (SEE CURVE TABLE)
POB	POINT OF BEGINNING
CP	CALCULATED POINT
PB	PLAT BOOK
DB	DEED BOOK
L	LINE (SEE LINE TABLE)
BLDG	BUILDING
CIP	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CONC	CONCRETE
CMU	CONCRETE MASONRY UNIT
CPP	CORRUGATED PLASTIC PIPE
DIP	DUCTILE IRON PIPE
E&T	ELECTRIC & TELEPHONE
FOC	FIBER OPTIC CABLE
GIP	GALVANIZED IRON PIPE
O/H	OVERHEAD
RCP	REINFORCED CONCRETE PIPE
U/G	UNDERGROUND
VCP	VITRIFIED CLAY PIPE
PVC	POLYVINYL CHLORIDE PIPE
FFE	FINISHED FLOOR ELEVATION
BF	BRADFORD PEAR

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NEW OPERATORS BUILDING FOR

CATWABA COUNTY LANDFILL

4017 ROCKY FORD RD, NEWTON, NC 28658

KEY PLAN

NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 08/24/26 COLLIN S. SELMA

REVISION

NO.	DESCRIPTION	DATE

DATE
AUGUST 25TH, 2026

ISSUE
CONSTRUCTION DOCUMENT ISSUE

SHEET TITLE
GENERAL NOTES

SHEET NO.
G-001

DOB FILE #: _____ DOB PAGE #: _____

MODEL:

TEMPLATE VERSION:

GENERAL EROSION CONTROL NOTES

1. FINISH GRADE TOLERANCES SHALL BE AS NOTED IN THE SPECIFICATIONS. THE ENGINEER MAY MAKE GRADE CHANGES AS REQUIRED IN THE FIELD WITHOUT EFFECTING THE UNIT BID PRICE FOR UNCLASSIFIED EXCAVATION.

2. UNLESS OTHERWISE STATED, ALL FILL AREAS SHALL BE CONSTRUCTED IN LAYERS OF 8" MAXIMUM THICKNESS, WITH WATER ADDED OR SOIL CONDITIONED TO THE OPTIMUM MOISTURE CONTENT AS DETERMINED BY THE ENGINEER AND COMPACTED WITH A SHEEP'S FOOT ROLLER TO A COMPACTION EQUAL TO OR GREATER THAN 95% (100% IN THE TOP 2' OF THE SUB GRADE BELOW ROADWAYS AND PARKING LOTS) OF THE DENSITY OBTAINED BY COMPACTING A SAMPLE OF THE MATERIAL IN ACCORDANCE WITH THE STANDARD PROCTOR METHOD OF MOISTURE-DENSITY RELATIONSHIP TEST, ASTM D698 OR AASHTO-99 UNLESS SPECIFIED IN OTHER SPECIFICATIONS.

3. ENTIRE AREA TO BE GRADED SHALL BE CLEARED AND GRUBBED. NO FILL SHALL BE PLACED ON ANY AREA NOT CLEARED AND GRUBBED.

4. ALL SOIL EROSION CONTROL MEASURES REQUIRED BY THE GRADING PLAN SHALL BE PERFORMED PRIOR TO GRADING, CLEARING OR GRUBBING. ALL EROSION CONTROL DEVICES SUCH AS SILT FENCES, ETC., SHALL BE MAINTAINED IN WORKABLE CONDITION FOR THE LIFE OF THE PROJECT AND SHALL BE REMOVED AT THE COMPLETION OF THE PROJECT ONLY ON THE ENGINEER'S APPROVAL. PAYMENT SHALL BE CONSIDERED INCIDENTAL TO CLEARING AND GRUBBING. IF DURING THE LIFE OF THE PROJECT, A STORM CAUSES SOIL EROSION WHICH CHANGES FINISH GRADES OR CREATES "GULLIES" AND "WASHED AREAS", THESE SHALL BE REPAIRED AT NO EXTRA COST, AND ALL SILT WASHED OFF OF THE PROJECT SITE ONTO ADJACENT PROPERTY SHALL BE REMOVED AS DIRECTED BY THE ENGINEER AT NO EXTRA COST. THE CONTRACTOR SHALL ADHERE TO ANY APPROVED EROSION CONTROL PLANS WHETHER INDICATED IN THE CONSTRUCTION PLANS OR UNDER SEPARATE COVER.

5. DISPOSABLE MATERIAL

5.1. CLEARING AND GRUBBING WASTES SHALL BE REMOVED FROM THE SITE AND PROPERLY DISPOSED OF BY THE CONTRACTOR AT HIS EXPENSE, UNLESS SPECIFIED OTHERWISE.

5.2. SOLID WASTES TO BE REMOVED, SUCH AS SIDEWALKS, CURBS, PAVEMENT, ETC., MUST BE PLACED IN SPECIFIC DISPOSAL AREAS DELINEATED ON THE PLANS OR REMOVED FROM THE SITE AS REQUIRED BY THE SPECIFICATIONS. THIS MATERIAL SHALL HAVE A MINIMUM COVER OF 2'. THE CONTRACTOR SHALL MAINTAIN SPECIFIED COMPACTION REQUIREMENTS IN THESE AREAS. WHEN DISPOSAL SITES ARE NOT PROVIDED, THE CONTRACTOR SHALL REMOVE THIS WASTE FROM THE SITE AND PROPERLY DISPOSE OF IT AT HIS EXPENSE.

5.3. ABANDONED UTILITIES SUCH AS CULVERTS, WATER PIPE, HYDRANTS, CASTINGS, PIPE APPURTENANCES, UTILITY POLES, ETC., SHALL BE THE PROPERTY OF THE SPECIFIC UTILITY AGENCY, OR COMPANY HAVING JURISDICTION. BEFORE THE CONTRACTOR CAN REMOVE, DESTROY, SALVAGE, REUSE, SELL OR STORE FOR HIS OWN USE ANY ABANDONED UTILITY, HE MUST PRESENT TO THE OWNER WRITTEN PERMISSION FROM THE UTILITY INVOLVED.

5.4. IF ON SITE BURNING IS AN ACCEPTABLE METHOD OF DISPOSING OF FLAMMABLE WASTES AND WHEN BURNING IS ANTICIPATED, THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND MEETING GOVERNING CODES. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OR HIS REPRESENTATIVE AS TO THE SPECIFIC LOCATION OF BURNING.

6. AFTER BURNING IS COMPLETED, PURE ASH MAY BE DISPOSED OF BY MIXING WITH FILL DIRT. ALL MATERIAL NOT TOTALLY BURNED SHALL BE DISPOSED OF AS SPECIFIED IN "B" ABOVE. THE CONTRACTOR SHALL NOT HOLD UP WORK PROGRESS FOR THE PURPOSE OF WAITING FOR A "BURNING DAY".

7. IN THE EVENT EXCESSIVE GROUNDWATER OR SPRINGS ARE ENCOUNTERED WITHIN THE LIMITS OF CONSTRUCTION, THE CONTRACTOR SHALL INSTALL NECESSARY UNDER DRAINS AND STONE AS DIRECTED BY THE ENGINEER. ALL WORK SHALL BE PAID BASED UPON UNIT BIDS, UNLESS SPECIFIED OTHERWISE.

8. THE CONTRACTOR IS RESPONSIBLE FOR THE COORDINATION OF ADJUSTMENT OF ALL UTILITY SURFACE ACCESSES WHETHER HE PERFORMS THE WORK OR A UTILITY COMPANY PERFORMS THE WORK.

9. THE CONTRACTOR SHALL CONTROL ALL "DUST" BY PERIODIC WATERING AND SHALL PROVIDE ACCESS AT ALL TIMES FOR PROPERTY OWNERS WITHIN THE PROJECT AREA AND FOR EMERGENCY VEHICLES. ALL OPEN DITCHES AND HAZARDOUS AREAS SHALL BE CLEARLY MARKED IN ACCORDANCE WITH THE SPECIFICATIONS.

10. ALL AREAS WHERE THERE IS EXPOSED DIRT SHALL BE SEEDED, FERTILIZED AND MULCHED ACCORDING TO THE SPECIFICATIONS. THE FINISHED SURFACE SHALL BE TO GRADE AND SMOOTH, FREE OF ALL ROCKS LARGER THAN 3", EQUIPMENT TRACKS, DIRT CLODS, BUMPS, RIDGES AND GOUGES PRIOR TO SEEDING; THE SURFACE SHALL BE LOOSENED TO A DEPTH OF ±4"-6" TO ACCEPT SEED. THE CONTRACTOR SHALL NOT PROCEED WITH SEEDING OPERATIONS WITHOUT FIRST OBTAINING THE ENGINEER'S APPROVAL OF THE GRADED SURFACE. ALL SEEDING SHALL BE PERFORMED BY A MECHANICAL "HYDRO-SEEDER". HAND SEEDING SHALL BE AUTHORIZED ON AN AREA BY AREA APPROVAL BY THE ENGINEER.

TEMPORARY SEEDBED PREPARATION

1. A GOOD SEEDBED IS WELL PULVERIZED, LOOSE, AND UNIFORM.

2. LIMING - APPLY LIME ACCORDING TO SOIL TEST RECOMMENDATIONS. IF THE pH (ACIDITY) OF THE SOIL IS NOT KNOW, AN APPLICATION OF GROUND AGRICULTURAL LIMESTONE AT THE RATE OF 1 - 1.5 TONS/ACRE ON FINE TEXTURED SOILS AND 2-3 TONS/ACRE ON COARSE TEXTURED SOILS IS USUALLY SUFFICIENT. APPLY LIMESTONE UNIFORMLY AND INCORPORATE INTO THE TOP 4-6 INCHES OF THE SOIL. SOILS WITH A pH OF 6 OR HIGHER NEED NOT BE LIMED.

3. FERTILIZER - BASE APPLICATION RATES ON SOIL TESTS. WHEN THESE ARE NOT POSSIBLE APPLY A 10-10-10 GRADE FERTILIZER AT 700 - 1000 LB/ACRE. BOTH FERTILIZER AND LIME SHOULD BE INCORPORATED INTO THE TOP 4-6 INCHES OF SOIL. IF A HYDRAULIC SEEDER IS USED, DO NOT MIX SEED AND FERTILIZER MORE THAN 30 MINUTES BEFORE APPLICATION.

4. SURFACE ROUGHENING - IF RECENT TILLAGE OPERATIONS HAVE RESULTED IN A LOOSE SURFACE, ADDITIONAL ROUGHENING MAY NOT BE REQUIRED, EXCEPT TO BREAK UP LARGE CLODS. IF RAINFALL CAUSES THE SURFACE TO BECOME SEALED OR CRUSTED, LOOSEN IT JUST PRIOR TO SEEDING BY DISKING, RAKING, HARROWING, OR OTHER SUITABLE METHODS. GROOVE OR FURROW SLOPES STEEPER THAN 3:1 ON THE CONTOUR BEFORE SEEDING. SEE OTHER REQUIREMENTS FOR SURFACE ROUGHENING ON THIS SHEET.

SURFACE ROUGHENING

CUT SLOPE ROUGHENING FOR AREAS NOT TO BE MOWED

-STAIR-STEP GRADE OR GROOVE CUT SLOPES WITH A GRADIENT STEEPER THAN 3:1.

-USE STAIR-STEP GRADING ON ANY ERODIBLE MATERIAL SOFT ENOUGH TO BE RIPPED WITH A BULLDOZER. SLOPES CONSISTING OF SOFT ROCK WITH SOME SUBSOIL ARE PARTICULARLY SUITED TO STAIR-STEP GRADING.

-MAKE THE VERTICAL CUT DISTANCE LESS THAN THE HORIZONTAL DISTANCE, & SLIGHTLY SLOPE THE HORIZONTAL POSITION OF THE "STEP" IN TOWARD THE VERTICAL WALL.

-DO NOT MAKE INDIVIDUAL VERTICAL CUTS MORE THAN 2 FEET IN SOFT MATERIALS OR MORE THAN 3 FEET IN ROCKY MATERIALS.

-GROOVING USES MACHINERY TO CREATE A SERIES OF RIDGES & DEPRESSIONS THAT RUN ACROSS THE SLOPE (ON THE CONTOUR).

-GROOVE USING ANY APPROPRIATE IMPLEMENT THAT CAN BE SAFELY OPERATED ON THE SLOPE, SUCH AS DISKS, TILLERS, SPRING HARROWS, OR THE TEETH ON A FRONT END LOADER BUCKET. DO NOT MAKE SUCH GROOVES LESS THAN 3 INCHES DEEP NOR MORE THAN 15 INCHES APART.

FILL SLOPE AREAS NOT TO BE MOWED

-PLACE FILL SLOPES WITH A GRADIENT STEEPER THAN 3:1 IN LIFTS NOT TO EXCEED 9 INCHES, & MAKE SURE EACH LIFT IS PROPERLY COMPACTED. ENSURE THAT THE FACE OF THE SLOPE CONSISTS OF LOOSE, UNCOMPACTED FILL 4-6 INCHES DEEP. USE GROOVING AS DESCRIBED ABOVE, TO ROUGHEN THE FACE OF THE SLOPES, IF NECESSARY.

-DO NOT BLADE OR SCRAPE THE FINAL SLOPE FACE.

CUTS FILLS & GRADED AREAS THAT WILL BE MOWED

-MAKE MOWED SLOPES NO STEEPER THAN 3:1

-ROUGHEN THESE AREAS TO SHALLOW GROOVES BY NORMAL TILLING, DISKING, HARROWING, OR USE OF CULTIPACK-SEEDER. MAKE THE FINAL PASS OF ANY SUCH TILLAGE IMPLEMENT ON THE CONTOUR.

-MAKE GROOVES, FORMED BY SUCH IMPLEMENTS, CLOSE TOGETHER (LESS THAN 10 INCHES) & NOT LESS THAN 1 INCH DEEP.

-EXCESSIVE ROUGHNESS IS UNDESIRABLE WHERE MOWING IS PLANNED.

ROUGHENING WITH TRACKED MACHINERY

-LIMIT ROUGHENING WITH TRACKED MACHINERY TO SANDY SOILS TO AVOID UNDUE COMPACTION OF THE SOIL SURFACE. TRACKING IS GENERALLY NOT AS EFFECTIVE AS THE OTHER ROUGHENING METHODS DESCRIBED.

-OPERATE TRACKED MACHINERY UP & DOWN THE SLOPE TO LEAVE HORIZONTAL DEPRESSIONS IN THE SOIL. DO NOT BACK-BLADE DURING THE FINAL GRADING OPERATION.

COMPLETE SEEDBED PREPARATION BY BREAKING UP LARGE CLODS & RAKING INTO A SMOOTH, UNIFORM SURFACE (SLOPES LESS THAN 3:1). FILL IN OR LEVEL DEPRESSIONS THAT CAN COLLECT WATER. BROADCAST SEED INTO A FRESHLY LOOSENED SEEDBED THAT HAS NOT BEEN SEALED BY RAINFALL.

TEMPORARY SEEDING SCHEDULE

(TO TEMPORARILY STABILIZE DENUDED AREAS THAT WILL NOT BE BROUGHT TO FINAL GRADE FOR A PERIOD OF 15 WORKING DAYS)

SEEDING DATES: DECEMBER 1 THRU APRIL 15

SEEDING MIXTURE: SPECIES	RATE (LBS/AC)
RYE (GRAIN)	120
ANNUAL LESPEDEZA (KOBE)	50

OMIT ANNUAL LESPEDEZA WHEN DURATION OF TEMPORARY COVER IS NOT TO EXTEND BEYOND JUNE

SOIL AMENDMENTS:
FOLLOW SOIL TESTS OR APPLY:
2,000 LBS/AC LIMESTONE AND
750 LB/AC 10-10-10 FERTILIZER

MULCH: 4,000 LBS/AC - ANCHOR STRAW BY TACKING WITH ASPHALT, NETTING, OR A MULCH ANCHORING TOOL. A DISK WITH BLADES SET NEARLY STRAIGHT CAN BE USED AS A MULCH ANCHORING TOOL.(1)

MAINTENANCE: REFERTILIZE IF GROWTH IS NOT FULLY ADEQUATE. RESEED, REFERTILIZE AND MULCH IMMEDIATELY FOLLOWING EROSION OR OTHER DAMAGE.

SEEDING DATES: APRIL 15 - AUGUST 15

SEEDING MIXTURE: SPECIES	RATE (LBS/AC)
GERMAN MILLET	40

SOIL AMENDMENTS:
FOLLOW SOIL TESTS OR APPLY:
2,000 LBS/AC LIMESTONE AND
750 LB/AC 10-10-10 FERTILIZER

MULCH: 4,000 LBS/AC - ANCHOR STRAW BY TACKING WITH ASPHALT, NETTING, OF A MULCH ANCHORING TOOL. A DISK WITH BLADES SET NEARLY STRAIGHT CAN BE USED AS A MULCH ANCHORING TOOL.(1)

MAINTENANCE: REFERTILIZE IF GROWTH IS NOT FULLY ADEQUATE. RESEED, REFERTILIZE AND MULCH IMMEDIATELY FOLLOWING EROSION OR OTHER DAMAGE.

SEEDING DATES: AUGUST 15 THRU DECEMBER 15

SEEDING MIXTURE: SPECIES	RATE (LBS/AC)
RYE (GRAIN)	120

SOIL AMENDMENTS:
FOLLOW SOIL TESTS OR APPLY:
2,000 LBS/AC LIMESTONE AND
1,000 LB/AC 10-10-10 FERTILIZER

MULCH: 4,000 LBS/AC - ANCHOR STRAW BY TACKING WITH ASPHALT, NETTING, OF A MULCH ANCHORING TOOL. (1)

(1) CHEMICAL MULCHES AND/OR SOIL BINDERS MAY BE USED ALONE OR, OR MAY BE USED TO TACK WOOD FIBER HYDROMULCHES. SYNTHETIC/CHEMICAL MULCHES SHALL NOT BE USED IN NON-TRAFFICKING AREAS. NO SYNTHETIC/CHEMICAL MULCHES SHALL BE USED THAT COULD BE HAZARDOUS TO FISH, WILDLIFE, OR WATER RESOURCES. TACK RATES SHALL FOLLOW MANUFACTURES SPECIFICATIONS FOR APPLICATION.

MAINTENANCE: REPAIR AND REFERTILIZE DAMAGED AREAS IMMEDIATELY. TOPDRESS WITH 50 LBS/AC OF NITROGEN IN MARCH. IF IT IS NECESSARY TO EXTEND TEMPORARY COVER BEYOND JUNE 15, OVERSEED WITH 50 LBS/AC KOBE IN LATE FEBRUARY OR EARLY MARCH

PERMANENT SEEDING OF GRASS LINED CHANNELS

(GRASS-LINED CHANNELS, COASTAL PLAIN AND LOWER PIEDMONT, NCDENR STD. SEEDING TABLE 6.11j)

SEEDING DATES:
APRIL - JULY

SEEDING MIXTURE:

SPECIES:	RATE:
COMMON BERMUDAGRASS	40-80 LB/AC (1-2 LB/1000SF)

SOIL AMENDMENTS:
APPLY LIME AND FERTILIZER ACCORDING TO SOIL TESTS, OR APPLY 3000 LB/AC GROUND AGRICULTURAL LIMESTONE AND 500 LB/AC 10-10-10 FERTILIZER.

MULCH:
USE A ROLLED EROSION CONTROL PRODUCT TO COVER THE BOTTOM OF CHANNELS AND DITCHES. THE LINING SHOULD EXTEND ABOVE THE HIGHEST CALCULATED DEPTH OF FLOW. ON CHANNEL SIDE SLOPES ABOVE THIS HEIGHT, AND IN DRAINAGES NOT REQUIRING TEMPORARY LININGS, APPLY 4000 LB/AC GRAIN STRAW AND ANCHOR STRAW BY STAPLING NETTING OVER THE TOP.

MAINTENANCE:
A MINIMUM OF 3 WEEKS IS REQUIRED FOR ESTABLISHMENT. INSPECT AND REPAIR MULCH FREQUENTLY. REFERTILIZE THE FOLLOWING APRIL ACCORDING TO SOIL TESTS OR APPLY 50 LB/AC NITROGEN.

PERMANENT SEEDING SCHEDULE

IN ROADWAY AREAS:

MARCH 1 - AUGUST 31:

SEED MIX:	RATE:
TALL FESCUE	50 LB/AC
CENTIPEDE	10 LB/AC
BERMUDAGRASS (HULLED)	25 LB/AC
SOIL AMENDMENTS:	RATE:
FERTILIZER (10-20-20)	500 LB/AC
LIMESTONE	4000 LB/AC

SEPTEMBER 1 - FEBRUARY 28:

SEED MIX:	RATE:
TALL FESCUE	50 LB/AC
CENTIPEDE	10 LB/AC
BERMUDA GRASS (UNHULLED)	35 LB/AC
SOIL AMENDMENTS:	RATE:
FERTILIZER (10-20-20)	500 LB/AC
LIMESTONE	4000 LB/AC

IN WASTE/BORROW AREAS:

MARCH 1 - AUGUST 31:

SEED MIX:	RATE:
TALL FESCUE	25 LB/AC
BERMUDAGRASS (HULLED)	75 LB/AC
SOIL AMENDMENTS:	RATE:
FERTILIZER (10-20-20)	500 LB/AC
LIMESTONE	4000 LB/AC

SEPTEMBER 1 - FEBRUARY 28:

SEED MIX:	RATE:
TALL FESCUE	75 LB/AC
BERMUDAGRASS (UNHULLED)	35 LB/AC
SOIL AMENDMENTS:	RATE:
FERTILIZER (10-20-20)	500 LB/AC
LIMESTONE	4000 LB/AC

MULCH:
APPLY 4,000 LB/ACRE GRAIN STRAW OR EQUIVALENT COVER OF ANOTHER SUITABLE MULCH. ANCHOR BY TACKING WITH ASPHALT, ROVING, NETTING, OR BY CRIMPING WITH A MULCH ANCHORING TOOL.

CHEMICAL MULCHES AND/OR SOIL BINDERS MAY BE USED ALONE OR, OR MAY BE USED TO TACK WOOD FIBER HYDROMULCHES. SYNTHETIC/CHEMICAL MULCHES SHALL NOT BE USED IN NON-TRAFFICKING AREAS. NO SYNTHETIC/CHEMICAL MULCHES SHALL BE USED THAT COULD BE HAZARDOUS TO FISH, WILDLIFE, OR WATER RESOURCES. TACK RATES SHALL FOLLOW MANUFACTURES SPECIFICATIONS FOR APPLICATION.

MAINTENANCE:
REFERTILIZE THE FOLLOWING APRIL WITH 50 LB/ACRE NITROGEN. REPEAT AS GROWTH REQUIRES. MAY BE MOWED AS OFTEN AS NEEDED.

NOTE: SEE NCDOT'S LATEST STANDARDS FOR STABILIZATION FOR MORE INFORMATION.

PERMANENT SEEDBED PREPARATION

1. INSTALL NECESSARY MECHANICAL EROSION AND SEDIMENTATION CONTROL PRACTICES BEFORE SEEDING, AND COMPLETE GRADING ACCORDING TO THE APPROVED PLAN.

2. LIME AND FERTILIZER NEEDS SHOULD BE DETERMINED BY SOIL TESTS. SOIL TESTING IS PERFORMED FREE OF CHARGE BY THE NC DEPT. OF AGRICULTURE. SOIL TESTING LABORATORY. DIRECTIONS, SAMPLE CARTONS, AND INFORMATION ARE AVAILABLE THROUGH COUNTY AGRICULTURAL EXTENSION OFFICES OR FROM NCDA. BECAUSE THE NCDA SOIL TESTING LAB REQUIRES 1-6 WEEKS FOR SAMPLE TURN-AROUND, SAMPLING MUST BE PLANNED WELL IN ADVANCE OF FINAL GRADING. TESTING IS ALSO DONE BY COMMERCIAL LABORATORIES.

3. WHEN SOIL TESTS ARE NOT AVAILABLE, FOLLOW RATES SUGGESTED IN THE PERMANENT SEEDING SCHEDULE ON THIS SHEET. APPLICATION RATES USUALLY FALL INTO THE FOLLOWING RANGES:

GROUND AGRICULTURAL LIMESTONE:
LIGHT TEXTURED, SANDY SOILS: 1 - 1.5 TONS/ACRE
HEAVY TEXTURED, CLAYEY SOILS: 2 - 3 TONS/ACRE

FERTILIZER:
GRASSES: 800 - 1200 LB/ACRE OF 10-10-10 (OR EQUIVALENT)
GRASS-LEGUME MIXTURES: 800 - 1200 LB/ACRE OF 5-10-10 (OR EQUIVALENT)

4. APPLY LIME AND FERTILIZER EVENLY AND INCORPORATE INTO THE TOP 4-6 INCHES OF SOIL BY DISKING OR OTHER SUITABLE MEANS. OPERATE MACHINERY ON THE CONTOUR.

5. ROUGHEN SURFACES IN ACCORDANCE WITH THE NOTES ON SURFACE ROUGHENING ON THIS SHEET.

6. COMPLETE SEEDBED PREPARATION BY BREAKING UP LARGE CLODS AND RAKING INTO A SMOOTH, UNIFORM SURFACE (SLOPES LESS THAN 3:1.) FILL IN OR LEVEL DEPRESSIONS THAT CAN COLLECT WATER. BROADCAST SEED INTO A FRESHLY LOOSENED SEEDBED THAT HAS NOT BEEN SEALED BY RAINFALL.

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CATAWBA COUNTY LANDFILL

NEW OPERATORS BUILDING FOR 4017 ROCKY FORD RD, NEWTON, NC 28658

KEY PLAN

NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT — 08/24/26 — SEAL 3115 — JOHN S. SELLERS

REVISION

NO.	DESCRIPTION	DATE

DATE
AUGUST 25TH, 2026

ISSUE
CONSTRUCTION DOCUMENT ISSUE

SHEET TITLE:
EROSION CONTROL NOTES

SHEET NO.
G-002

DOB FILE #: _____ DOB PAGE #: _____

MODEL:

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10 0 5 10 20

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NEW OPERATORS BUILDING FOR
CATWABA COUNTY LANDFILL
4017 ROCKY FORD RD, NEWTON, NC 28658

KEY PLAN

NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 3018 COLLINS SUMMEY 08/24/26

REVISION

NO.	DESCRIPTION	DATE

DATE
AUGUST 25TH, 2026

ISSUE
CONSTRUCTION DOCUMENT ISSUE

SHEET TITLE
EXISTING CONDITIONS AND DEMOLITION PLAN

SHEET NO.
C-001

DOB FILE #: _____ DOB PAGE #: _____

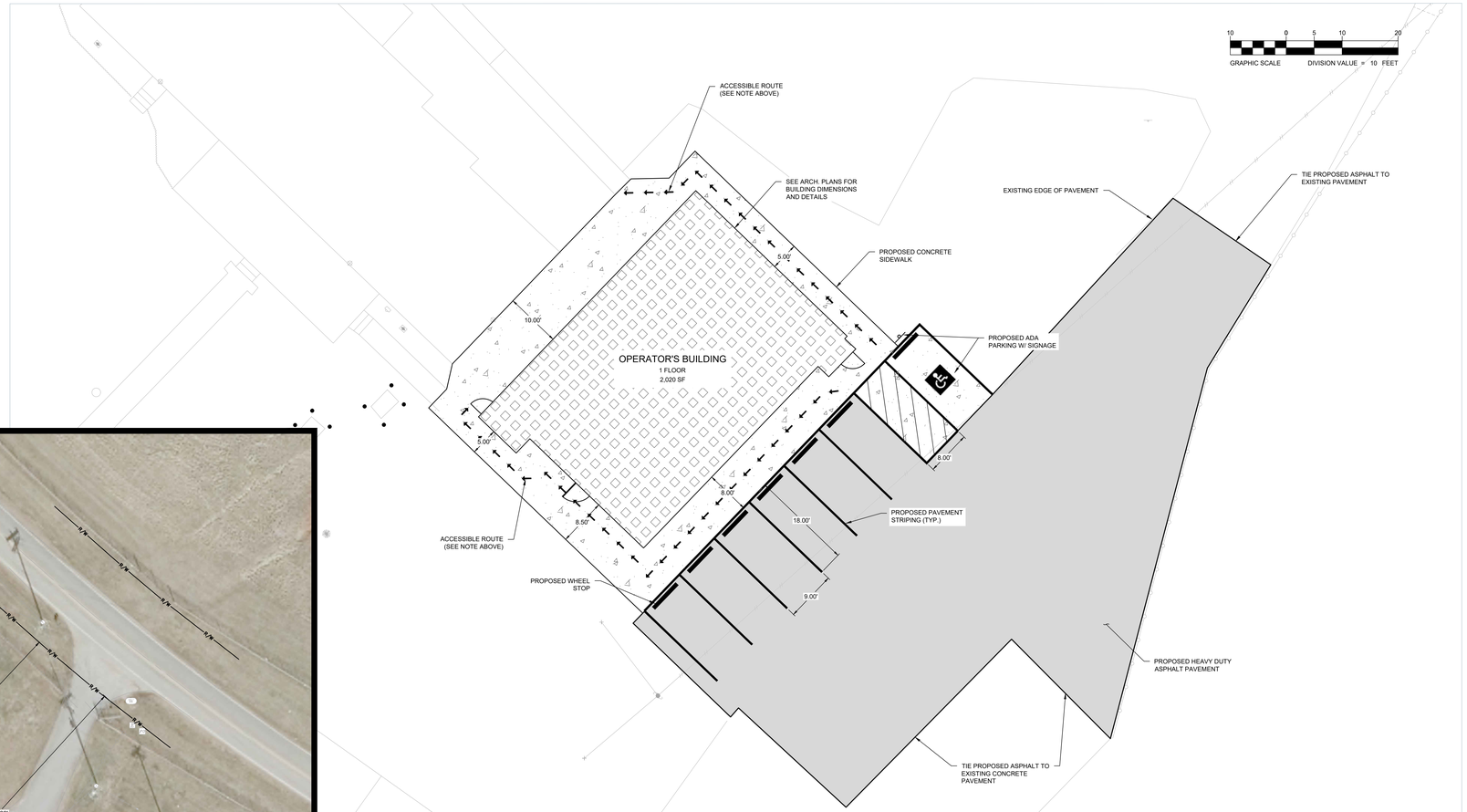
MODEL

TEMPLATE VERSION

ACCESSIBILITY COMPLIANCE NOTES

1. ALL ACCESSIBLE FEATURES AND ROUTES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF THE ADA STANDARDS FOR ACCESSIBLE DESIGN, ANSI A117.1, APPLICABLE BUILDING CODE REQUIREMENTS, AND PROJECT SPECIFICATIONS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING AND CONSTRUCTING ALL ACCESSIBLE ELEMENTS TO COMPLY WITH REQUIRED DIMENSIONS, SLOPES, CROSS SLOPES, ELEVATIONS, CLEARANCES, AND TRANSITIONS PRIOR TO PLACEMENT OF CONCRETE.
3. ACCESSIBLE PARKING SPACES AND ACCESS AISLES SHALL COMPLY WITH ALL APPLICABLE DIMENSIONAL AND SLOPE REQUIREMENTS. SURFACE SLOPES WITHIN ACCESSIBLE PARKING SPACES AND ACCESS AISLES SHALL NOT EXCEED 2.0% IN ANY DIRECTION.
4. ACCESSIBLE PEDESTRIAN ROUTES AND SIDEWALKS SHALL MAINTAIN A MAXIMUM CROSS SLOPE OF 2.0%. RUNNING SLOPES SHALL COMPLY WITH ADA AND APPLICABLE CODE REQUIREMENTS. ANY CHANGES IN LEVEL SHALL COMPLY WITH APPLICABLE ACCESSIBILITY STANDARDS.
5. ACCESSIBLE LANDING AREAS SHALL BE PROVIDED AT ALL ACCESSIBLE ENTRY DOORS, GATES, AND TRANSITIONS ALONG THE ACCESSIBLE ROUTE. LANDING AREAS SHALL COMPLY WITH APPLICABLE DIMENSIONAL AND SLOPE REQUIREMENTS AND SHALL NOT EXCEED 2.0% SLOPE IN ANY DIRECTION UNLESS OTHERWISE PERMITTED BY CODE.
6. CURB RAMPS AND SIDEWALK RAMPS SHALL COMPLY WITH APPLICABLE ADA REQUIREMENTS RELATED TO WIDTH, SLOPE, CROSS SLOPE, DETECTABLE WARNINGS, TRANSITIONS, AND LANDING REQUIREMENTS. RAMP RUNNING SLOPES SHALL NOT EXCEED 8.33% UNLESS OTHERWISE APPROVED BY THE ENGINEER AND PERMITTED BY APPLICABLE STANDARDS.
7. DETECTABLE WARNING SURFACES SHALL BE INSTALLED WHERE REQUIRED BY APPLICABLE ACCESSIBILITY STANDARDS AND JURISDICTIONAL REQUIREMENTS.
8. THE CONTRACTOR SHALL NOTIFY THE ENGINEER A MINIMUM OF 48 HOURS PRIOR TO PLACEMENT OF CONCRETE FOR ALL ACCESSIBLE ELEMENTS, INCLUDING BUT NOT LIMITED TO SIDEWALKS, CURB RAMPS, ACCESSIBLE PARKING SPACES, ACCESS AISLES, LANDING PADS, AND ACCESSIBLE ROUTES.
9. CONCRETE ASSOCIATED WITH ACCESSIBLE ELEMENTS SHALL NOT BE PLACED UNTIL THE CONTRACTOR HAS COMPLETED FORMWORK AND FINE GRADING AND THE ENGINEER HAS BEEN PROVIDED THE OPPORTUNITY TO PERFORM A FIELD REVIEW OF THE PROPOSED CONSTRUCTION.
10. ANY WORK CONSTRUCTED THAT DOES NOT COMPLY WITH APPLICABLE ACCESSIBILITY REQUIREMENTS SHALL BE CORRECTED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.





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TEMPLATE VERSION:

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NEW OPERATORS BUILDING FOR
CATWABA COUNTY LANDFILL
4017 ROCKY FORD RD, NEWTON, NC 28658

KEY PLAN

NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 08/24/26 COLLIN S. SUMMEY

REVISION

NO.	DESCRIPTION	DATE

DATE
AUGUST 25TH, 2026

ISSUE
CONSTRUCTION DOCUMENT ISSUE

SHEET TITLE
SITE PLAN

SHEET NO.
C-100

DOB FILE #: _____ DOB PAGE #: _____

ACCESSIBILITY COMPLIANCE NOTES

1. ALL ACCESSIBLE FEATURES AND ROUTES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF THE ADA STANDARDS FOR ACCESSIBLE DESIGN, ANSI A117.1, APPLICABLE BUILDING CODE REQUIREMENTS, AND PROJECT SPECIFICATIONS.
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10. ANY WORK CONSTRUCTED THAT DOES NOT COMPLY WITH APPLICABLE ACCESSIBILITY REQUIREMENTS SHALL BE CORRECTED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.

CATAWBA COUNTY
PIN # 3618-0452-2134
DB 3893 PG 1341

EXISTING BUILDING
FFE: 932.65'

OPERATOR'S BUILDING
1 FLOOR
2,020 SF
FFE: 932.65'

ACO S200K SLOPED TRENCH DRAIN W/ PEDESTRIAN GRATE (OR APPROVED EQUAL)
INV: 931.89'
LP: 932.56'
47 LF TRENCH DRAIN
RIM ELEVATION OF GRATE TO BE SET AT 932.56'
TIE 4" PVC ROOF DRAIN TO TRENCH DRAIN

ACO SK2 600 SERIES CATCH BASIN W/ SOLID TOP (OR APPROVED EQUAL)
RIM: 932.54'
INV IN: 931.65'
INV OUT: 929.26'
TIE 4" PVC ROOF DRAIN TO TRENCH DRAIN

TIE 4" PVC ROOF DRAIN TO CATCH BASIN

DISCHARGE 4" PVC ROOF DRAIN TO GRADE

SILT FENCE (TYP.)

MATCH EXISTING GRADES

INLET PROTECTION (SEE DETAIL)

PIPE OUTLET PROTECTION (SEE DETAIL)

12" PVC
INV IN (SE)=926.54'
INV OUT (NW)=925.80'

53 LF 12" Ø HDPE @ 2.72%

CONCRETE ENDWALL (SEE DETAIL)
INV: 927.82'

SSMH #9500
RIM:928.50'
INV IN (N)=923.40'
INV OUT (SW)=923.30'

LIMITS OF DISTURBANCE

"UNNEL."
17 NAD83 (2011) COORDS:
05.17"
306.31'
ELEVATION: 914.86'
ENT NOT IN NGS DATABASE

GRAPHIC SCALE 10 0 5 10 20
DIVISION VALUE = 10 FEET

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NEW OPERATORS BUILDING FOR
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KEY PLAN

NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 08124 COLIN S. SMITH

REVISION

NO.	DESCRIPTION	DATE

DATE
AUGUST 25TH, 2026

ISSUE
CONSTRUCTION DOCUMENT ISSUE

SHEET TITLE
GRADING, DRAINAGE AND EROSION CONTROL PLAN

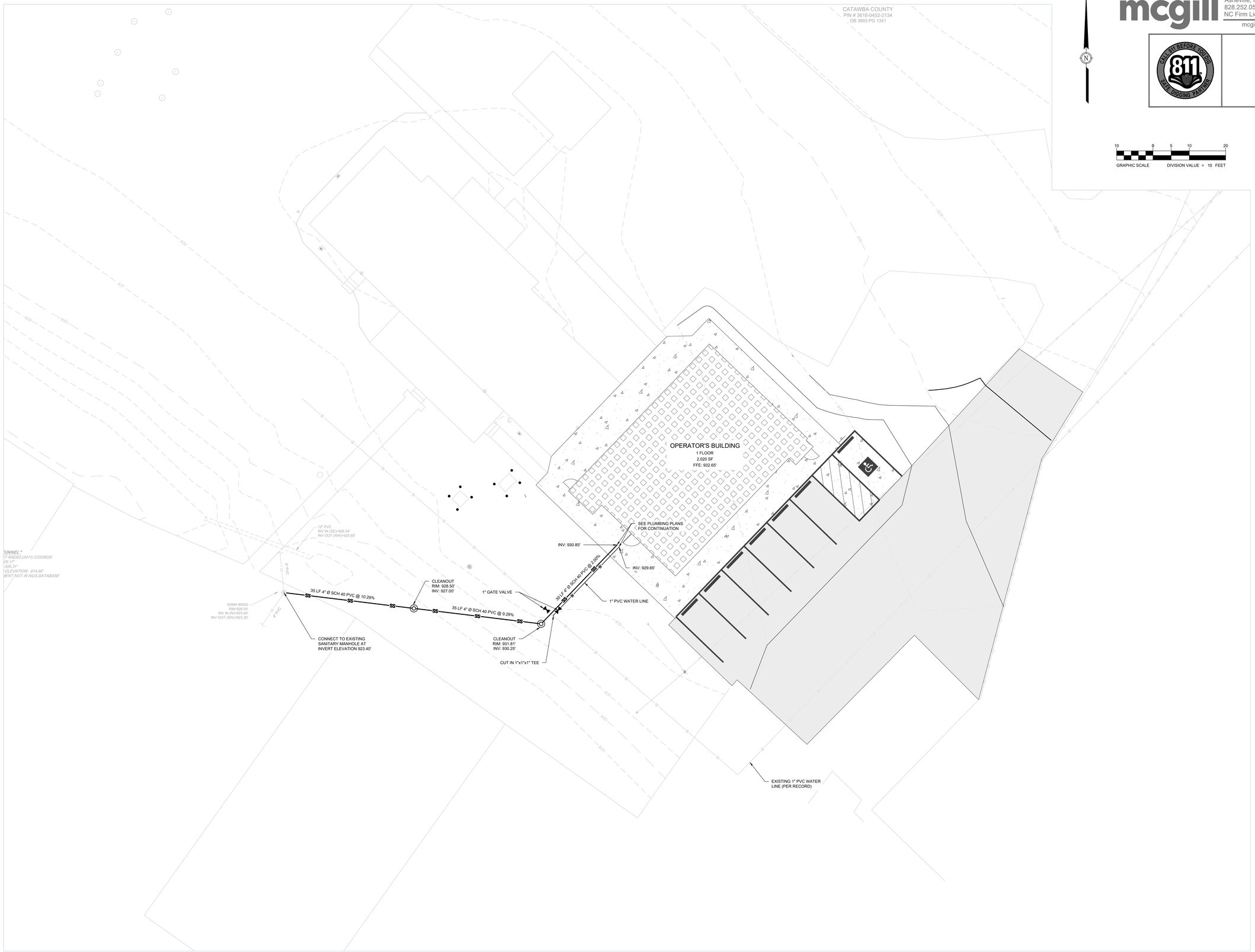
SHEET NO.
C-200

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NEW OPERATORS BUILDING FOR
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4017 ROCKY FORD RD, NEWTON, NC 28658

KEY PLAN

NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 08/24/26 LICENSED LANDSCAPE ARCHITECT

REVISION

NO.	DESCRIPTION	DATE

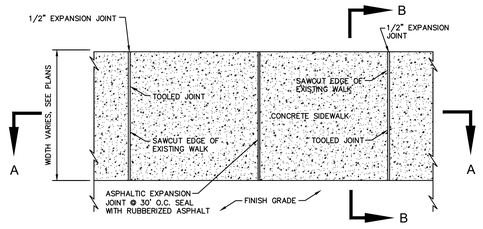
DATE
AUGUST 25TH, 2026

ISSUE
CONSTRUCTION DOCUMENT ISSUE

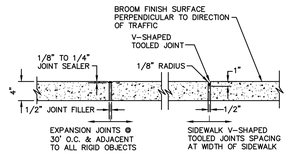
SHEET TITLE
UTILITY PLAN

SHEET NO.
C-300

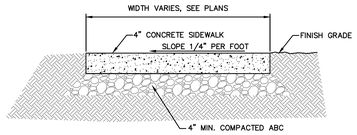
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PLAN



SECTION A-A



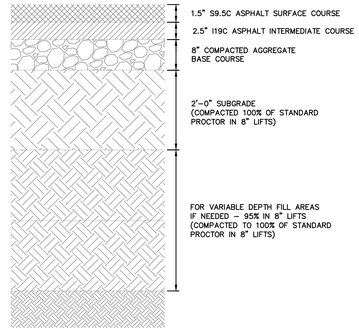
SECTION B-B

CONSTRUCTION NOTES:

1. SIDEWALK SHALL BE CONSTRUCTED WITH 4000 PSI CONCRETE.
2. SIDEWALK SURFACE SHALL BE GIVEN A LIGHT BROOM FINISH WITH THE BRUSH MARKS PERPENDICULAR TO THE TRAFFIC.

ST 19 CONCRETE SIDEWALK

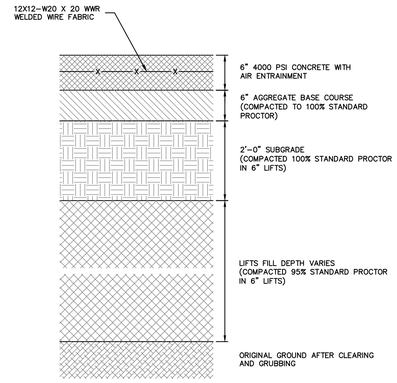
UPDATED MARCH, 2017
NOT TO SCALE



HEAVY DUTY

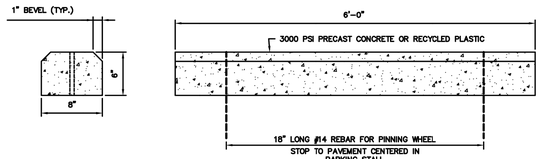
ST 12 PAVEMENT CROSS SECTION

UPDATED MARCH, 2017
NOT TO SCALE



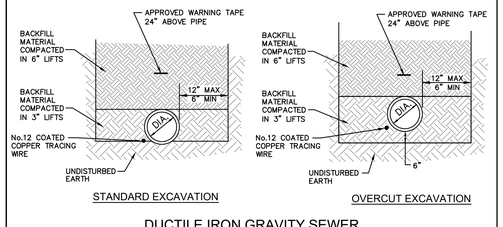
ST 41 CONCRETE PAVING CROSS SECTION

NOT TO SCALE

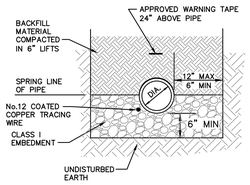


ST 35 WHEEL STOP DETAIL

UPDATED MARCH, 2017
NOT TO SCALE

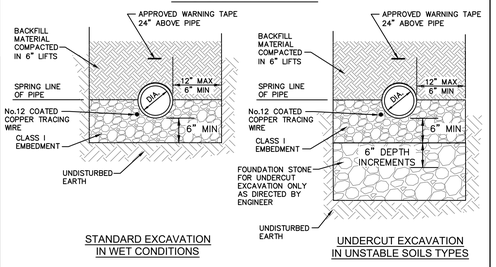


DUCTILE IRON GRAVITY SEWER



STANDARD EXCAVATION

PVC GRAVITY SEWER



STANDARD EXCAVATION IN WET CONDITIONS

UNDERCUT EXCAVATION IN UNSTABLE SOILS TYPES

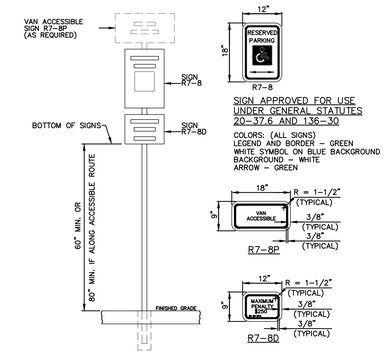
PIPE IN WET OR UNSTABLE CONDITIONS
ALL PIPE TYPES
(AS DIRECTED BY ENGINEER)

NOTES:

1. CONSTRUCTION OF TRENCHES SHALL COMPLY WITH ALL FEDERAL, STATE AND LOCAL SAFETY AND HEALTH REGULATIONS WHICH HAVE JURISDICTION AT THE PROJECT SITE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BE FAMILIAR WITH THE APPLICABLE REGULATIONS AND FOLLOW THEM ACCORDINGLY.
2. FOR UNIT PRICE CONTRACTS ONLY, PAYMENT FOR ROCK EXCAVATION AND SELECT BACKFILL IN TRENCH SHALL BE FOR ACTUAL QUANTITIES AND SHALL NOT EXCEED THE WIDTH OF TRENCH SHOWN ON THIS DETAIL.
3. FOR UNIT PRICE CONTRACTS ONLY, PAYMENT FOR FOUNDATION STONE UNDERCUT SHALL BE FOR THE LENGTH OF THE TRENCH REQUIRING UNDERCUT X 6" DEPTH INCREMENTS TO THE DEPTH REQUIRED.
4. CLASS I EMBEDMENT SHALL BE NCDOT STANDARD # 67 STONE OR APPROVED EQUAL. FOUNDATION STONE SHALL BE NCDOT STANDARD # 57, # 67 STONE, RAILROAD BALLAST OR APPROVED EQUAL.

S 4 GRAVITY SEWER TRENCHING DETAILS

UPDATED MARCH, 2017
NOT TO SCALE



SIGN APPROVED FOR USE UNDER GENERAL STATUTES 20-37.6 AND 136-30

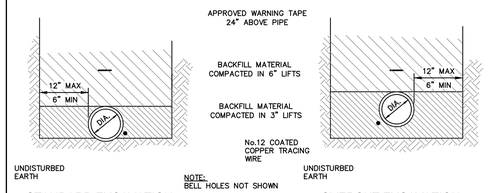
COLORS: (ALL SIGNS)
LEGEND AND BORDER - GREEN
WHITE SYMBOL ON BLUE BACKGROUND
BACKGROUND - WHITE
ARROW - GREEN

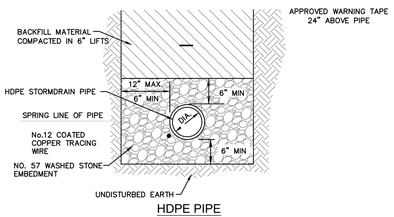
GENERAL NOTES:

1. REGARDLESS OF AGE, ALL ACCESSIBLE SPACES SHALL BE IDENTIFIED BY ABOVE-GROUND SIGNS ONLY. (SEE N.C.G.S.) SPACES SHALL NOT USE GROUND-PAINTED SYMBOLS.

ST 28 HANDICAP PARKING SIGNAGE

UPDATED MARCH, 2017
NOT TO SCALE





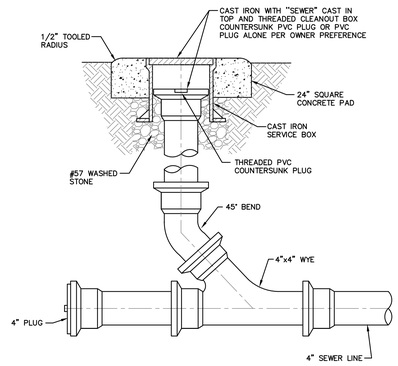
HDPE PIPE

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2. PAYMENT FOR ROCK EXCAVATION AND SELECT BACKFILL IN TRENCH SHALL BE FOR ACTUAL QUANTITIES AND SHALL NOT EXCEED THE WIDTH OF TRENCH SHOWN ON THIS DETAIL.

SD 15 STORM DRAIN TRENCH DETAIL

UPDATED JULY, 2022
NOT TO SCALE



S 3 CLEANOUT DETAIL

UPDATED MARCH, 2017
NOT TO SCALE

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NEW OPERATORS BUILDING FOR CATAWBA COUNTY LANDFILL

4017 ROCKY FORD RD, NEWTON, NC 28658

KEY PLAN

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 039241 ENGINEERING, P.C. CERTIFICATE OF AUTHORIZATION NO. C-0459 SEALED IN SELANIA

REVISION

NO.	DESCRIPTION	DATE

DATE
AUGUST 25TH, 2026

ISSUE
CONSTRUCTION DOCUMENT ISSUE

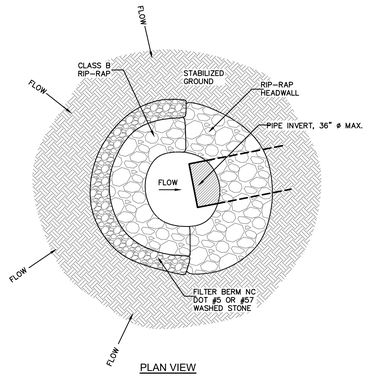
SHEET TITLE
DETAILS

SHEET NO.
C-500

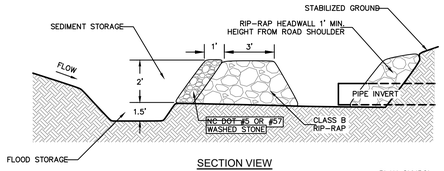
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MODEL

TEMPLATE VERSION



PLAN VIEW



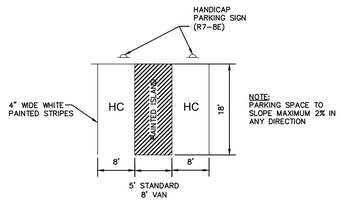
SECTION VIEW

PLAN SYMBOL

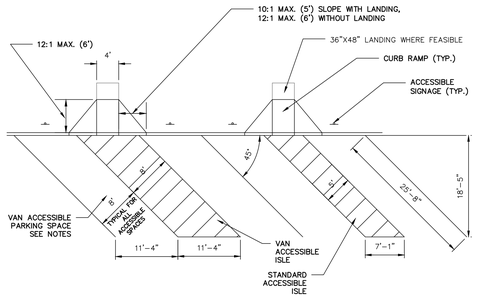
5

EC 18 PIPE INLET PROTECTION

UPDATED MARCH, 2017
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ACCESSIBLE STRIPING FOR HANDICAP PARKING

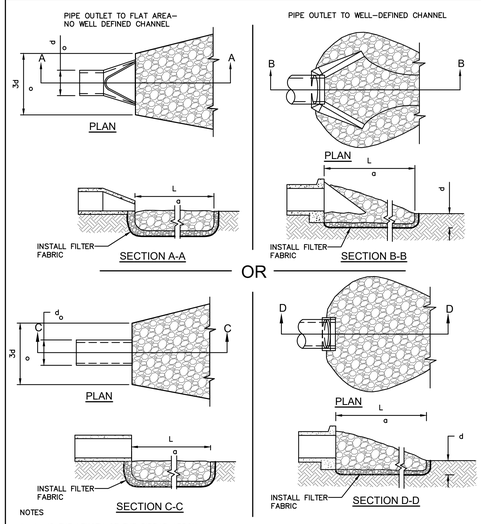


GENERAL NOTES:
1. WHERE ACCESSIBLE PARKING IS REQUIRED, THE NUMBER OF PARKING SPACES SHALL BE IN ACCORDANCE WITH THE CURRENT ADA STANDARDS. A MINIMUM OF 1 VAN ACCESSIBLE SPACE SHALL BE PROVIDED.
2. WHERE FEASIBLE, THE VAN ACCESSIBLE SPACES SHOULD BE PLACED ON THE LEFT SIDE OF THE ACCESS ISLE TO ACCOMMODATE SIDE ENTRY.
3. PARKING SPACE(S) AND ISLE(S) ARE TO SLOPE MAXIMUM 2% IN ANY DIRECTION.
4. DIMENSIONS SHOWN ARE MINIMUMS. LOCAL CODES MAY BE DIFFERENT.
5. ALL MARKINGS ARE TO BE STRIPED OFF TO PROVIDE PARKING. BLUE STRIPING COLOR IS NOT REQUIRED. FOR NCDOT, STRIPING TO BE WHITE ON DARK PAVEMENT AND BLACK ON LIGHT PAVEMENT.
6. RAMP DIMENSIONS BASED ON 6" CURB HEIGHT.
7. DETECTIBLE WARNING PLATES ARE NOT REQUIRED UNLESS ISLES ARE PART OF A STREET CROSSING.

ACCESSIBLE STRIPING FOR 45 ° HANDICAP PARKING

ST 31 ACCESSIBLE STRIPING DETAIL

UPDATED MARCH, 2017
NOT TO SCALE



NOTES
1. Lo IS THE LENGTH OF THE RIPRAP APRON
2. d= 1.5 TIMES THE MAXIMUM STONE DIAMETER BUT NOT LESS THAN 6".
3. IN A WELL-DEFINED CHANNEL EXTEND THE APRON UP THE CHANNEL BANKS TO AN ELEVATION OF 6" ABOVE THE MAXIMUM TAILWATER DEPTH OR TO THE TOP OF THE BANK, WHICHEVER IS LESS.
4. FILTER FABRIC SHOULD BE INSTALLED BETWEEN THE RIPRAP AND SOIL FOUNDATION.
5. REFERENCE NCDEQ LAND QUALITY SECTION DESIGN MANUAL: 6.41.

RIPRAP APRON SIZING

OUTLET No.	PIPE DIAMETER (Do)	3 x Do	APRON LENGTH (Lo)	APRON WIDTH (W=Do+Lo)	RIPRAP SIZE (d_{50}xTHICKNESS)
1	12"	3'	4'	5'	4"

EC 17 PIPE OUTLET PROTECTION

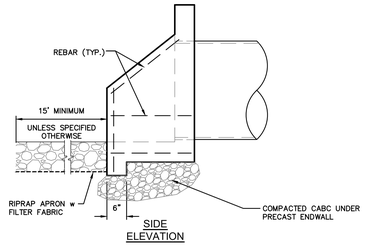
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ENDWALL DIMENSIONS (METAL PIPE)

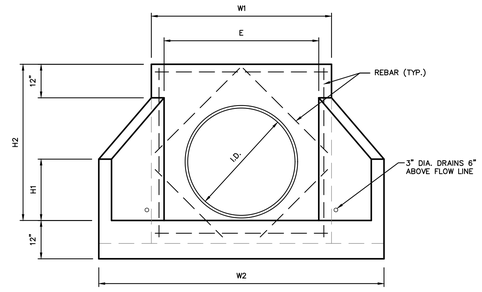
NOTE: USE NEXT LARGEST SIZE FOR CONCRETE PIPE.

INSIDE DIAMETER OF PIPE	W1	W2	H1	H2	D	E	WEIGHT	SQ. FT. BASE AREA
12"-15"-18"	3'-2"	4'-10"	1'-3"	3'-2"	1'-3"	1'-9"	1,550	7.34
21"-24"	3'-8"	6'-1"	1'-9"	3'-8"	1'-6"	2'-3"	2,100	9.90
30"	4'-2"	7'-2"	2'-0"	4'-2"	1'-10"	2'-9"	2,850	13.50
36"	4'-8"	8'-4"	2'-4"	4'-8"	2'-2"	3'-3"	3,700	17.65
42"-48"	5'-8"	10'-10"	3'-3"	5'-8"	2'-11"	4'-3"	5,600	28.60
54"-60"	6'-10"	11'-9"	3'-6"	6'-8"	3'-4"	5'-2"	7,500	36.27
66"-72"	8'-1"	12'-0"	3'-8"	7'-7"	3'-4"	6'-2"	8,500	40.00
84"-96"	9'-4"	12'-8"	4'-0"	9'-6"	3'-4"	7'-6"	10,000	44.00

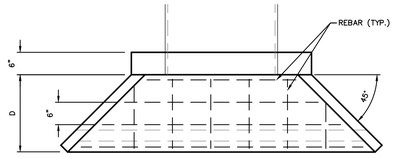
NOTE:
1. 4000 PSI CONCRETE STANDARD
2. FOR DOUBLE PIPE ENDWALL, REFER TO N.C.D.O.T. STANDARD NO. 838.01



SIDE ELEVATION



FRONT ELEVATION



PLAN

NOTES:
1. CONCRETE HEADWALL REINFORCEMENT PER N.C.D.O.T. STANDARD NO. 838.39 REVISION A.
2. WORK MUST BE ACCOMPLISHED SO THAT WET CONCRETE DOES NOT CONTACT STREAM WATER.

SD 9 REINFORCED CONCRETE ENDWALL

UPDATED MARCH, 2017
NOT TO SCALE

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NEW OPERATORS BUILDING FOR CATWABA COUNTY LANDFILL

4017 ROCKY FORD RD, NEWTON, NC 28658

KEY PLAN

NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 10/24/26 SEAL L-5116 SIGNED, NOT SEALED OR VALID IN ELECTRONIC FORM

REVISION

NO.	DESCRIPTION	DATE

DATE
AUGUST 25TH, 2026

ISSUE
CONSTRUCTION DOCUMENT ISSUE

SHEET TITLE
DETAILS

SHEET NO.
C-501

DOB FILE #: _____ DOB PAGE #: _____

MODEL

TEMPLATE VERSION

2018 APPENDIX B: STRUCTURAL DESIGN

DESIGN LOADS:

IMPORTANCE FACTORS: SNOW (I_s) 1.0 / SEISMIC (I_E) 1.0

LIVE LOADS: ROOF 20 psf / MEZZANINE N/A psf / FLOOR 100 psf

GROUND SNOW LOAD: 24 PSF

WIND LOAD: ULTIMATE WIND SPEED 108 MPH (ASCE-7) / EXPOSURE CATEGORY B

SEISMIC DESIGN CATEGORY: ☐ A ■ B ☐ C ☐ D

PROVIDE THE FOLLOWING SEISMIC DESIGN PARAMETERS:

RISK CATEGORY (TABLE 1604.5) ☐ I ■ II ☐ III ☐ IV

SPECTRAL RESPONSE ACCELERATION S_s .27 %G S_1 .087 %G

SITE CLASSIFICATION (ASCE 7) ☐ A ☐ B ☐ C ■ D ☐ E ☐ F

DATA SOURCE: ☐ FIELD TEST ☐ PRESUMPTIVE ☐ HISTORICAL DATA

BASIC STRUCTURAL SYSTEM (CHECK ONE)

■ BEARING WALL ☐ DUAL W/SPECIAL MOMENT FRAME
☐ BUILDING FRAME ☐ DUAL W/INTERMEDIATE R/C OR SPECIAL STEEL
☐ MOMENT FRAME ☐ INVERTED PENDULUM

ANALYSIS PROCEDURE: ☐ SIMPLIFIED ☐ EQUIVALENT LATERAL FORCE ☐ DYNAMIC

ARCHITECTURAL, MECHANICAL, COMPONENTS ANCHORED? ☐ YES ☐ NO

LATERAL DESIGN CONTROL: EARTHQUAKE ☐ WIND ■

SOIL BEARING CAPACITIES:

FIELD TEST (PROVIDE COPY OF TEST REPORT) _____ psf

PRESUMPTIVE BEARING CAPACITY 2,000 psf

PILE SIZE, TYPE, AND CAPACITY N/A

STRUCTURAL NOTES

A. GENERAL

1. THE PROVIDED DRAWINGS ARE LIMITED TO THE ITEMS SPECIFIED HEREIN. NO OPINION IS OFFERED, AND NONE SHOULD BE INFERRED REGARDING OTHER ASPECTS OF THIS STRUCTURE, OR THE STRUCTURES TAKEN AS A WHOLE. ANY ASSOCIATED REMEDIES EXPRESSED OR REFERENCED ARE EXCLUSIVE TO THE ITEMS SPECIFIED HEREIN. NO WARRANTY IS EXPRESSED OR IMPLIED.
2. THE DRAWINGS CONTAINED HEREIN, IN-WHOLE OR IN-PART, REMAIN THE PROPERTY OF MEDLOCK & ASSOCIATES ENGINEERING, PA. THE DRAWINGS MAY NOT BE USED, TRANSFERED OR REPRODUCED FOR ANY PROJECT OTHER THAN THAT SPECIFIED WITHIN THE DRAWINGS WITHOUT WRITTEN CONSENT FROM MEDLOCK & ASSOCIATES ENGINEERING, PA.
3. ALL WORK SHALL BE IN ACCORDANCE WITH THE CURRENT EDITION OF THE INTERNATIONAL BUILDING CODE, AS ADOPTED AND SUPPLEMENTED BY LOCAL REGULATIONS.
4. PROTECTION AND SAFETY:
THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR AND SHALL COMPLY THE PROTECTION AND SAFETY REQUIREMENTS OF THE STATE OF NORTH CAROLINA STATE BUILDING CODE , FEDERAL LAWS AND ALL LOCAL REGULATIONS. THE ENGINEER OR HIS EMPLOYEES ARE NOT RESPONSIBLE FOR SAFETY AND PROTECTION PROCEDURES ON THIS PROJECT.
5. THE GENERAL CONTRACTOR AND ALL SUBCONTRACTORS SHALL VERIFY ALL DIMENSIONS, ELEVATIONS, LEVELS AND SITE CONDITIONS PRIOR TO START OF CONSTRUCTION. THEY SHALL REPORT ANY ERRORS, DISCREPANCIES OR INCONSISTENCIES TO THE ARCHITECT / ENGINEER (A/E) PRIOR TO COMMENCING WORK. THE GENERAL CONTRACTOR AND ALL SUBCONTRACTORS SHALL LAYOUT THEIR WORK FROM ESTABLISHED REFERENCE POINTS AND SHALL BE RESPONSIBLE FOR ALL MESURMENTS AND ELEVATIONS IN CONNECTION WITH THEIR WORK.
6. IN THE EVENT ANY OMISSIONS OR ERRORS APPEAR IN THE DRAWINGS, SPECIFICATIONS OR OTHER DOCUMENTS, THE GENERAL CONTRACTOR SHALL NOTIFY THE STRUCTURAL ENGINEER IN WRITING OF SUCH ERRORS OR OMISSIONS PRIOR TO PROCEEDING WITH WORK WHICH MAY BE IN QUESTION. IF THE GENERAL CONTRACTOR OR ANY SUBCONTRACTORS FAIL TO GIVE SUCH NOTICE, HE SHALL BE HELD RESPONSIBLE FOR THE RESULTS OF ANY SUCH ERRORS OR OMISSIONS AND THE COST OF RECTIFYING THE SAME.
7. NO CHANGES TO THE INFORMATION SHOWN ON THE DRAWINGS OR SUBSTITUTIONS OF MATERIALS SHALL BE MADE WITHOUT THE SPECIFIC WRITTEN APPROVAL OF THE STRUCTURAL ENGINEER.
8. DESIGN INFORMATION SHOWN ON THE DRAWINGS PROVIDE OVERALL DIMENSIONAL PARAMETERS AND DESCRIBE ELEMENTS TO BE CONSTRUCTED AND ARE IN-PART DIAGRAMMATIC. THE DRAWINGS ARE NOT INTENDED TO BE SCALED FOR ROUGH-IN MEASUREMENTS OR TO SERVE AS SHOP DRAWINGS OR PORTTIONS THEREOF.
9. PRE-ENGINEERED WOOD MEMBERS SUCH AS TRUSSES OR SIMILAR BUILDING ELEMENTS SHALL BE DESIGNED BY THE MANUFACTURER UNLESS OTHERWISE NOTED ON THE PLANS. ALL LOADING AND DEFLECTION CRITERIA SHALL BE COORDINATED WITH THE OWNER OR ARCHITECT DIRECTLY FOR APPROVAL.
10. ALL INFORMATION REGARDING PRE-ENGINEERED BUILDING COMPONENTS (EG: MANUF. TRUSS LAYOUT AND LOADING) SHALL BE PROVIDED TO ENGINEER OF RECORD FOR COORDINATION AND LOAD VERIFICATION PRIOR TO CONSTRUCTION.
11. NO SHOP DRAWINGS SHALL BE SUBMITTED FOR ARCHITECTURAL / STRUCTURAL ENGINEER REVIEW UNTIL AFTER THEY HAVE BEEN REVIEWED AND NOTED FOR CONSTRUCTION METHOD, DIMENSIONING AND OTHER TRADE REQUIREMENTS BY THE CONTRACTOR AND STAMPED WITH THE CONTRACTOR'S APPROVAL SEAL. THE STRUCTURAL ENGINEER ASSUMES NO REPONSIBLITY FOR DIMENSIONS, QUANITTIES , ERRORS OR OMISSIONS AS A RESULT OF CHECKING AND REVIEWING ANY SHOP DRAWINGS. ANY ERRORS OR OMISSIONS SHALL BE RECTIFIED BY THE CONTRACTOR, IRRESPECTIVE OF RECEIPT, CHECKING OR REVIEW OF DRAWINGS BY STRUCTURAL ENGINEER REGARDLESS IF WORK IS DONE IN ACCORDANCE WITH SUCH DRAWINGS.
12. THE REVIEW OF ALL STRUCTURAL SUBMITTALS BY THE STRUCTURAL ENGINEER OF RECORD SHALL BE TO INSURE THE THE INTENT HAS BEEN UNDERSTOOD AND THAT THE SPECIFIED CRITERIA HAVE BEEN USED. A COPY OF ALL STRUCTURAL SUBMITTALS WILL BE RETAINED FOR RECORD KEEPING PURPOSES ONLY. WHERE CRITICAL DIMENSIONS CANNOT BE DETERMINED FROM THE PLANS OR WHERE NEW WORK ADJOINS EXISTING CONSTRUCTION, OR WHERE ONE MATERIAL ADJOINS AN IN-PLACE MATERIAL, THE CONTRACTOR SHALL TAKE FIELD MEASUREMENTS AS REQUIRED TO COMPLETE SHOP DRAWINGS AND INSTALLATION. REPORT ANY DISCREPANCIES EXCEEDING 3% BETWEEN FIELD MEASURED DIMENSIONS AND SCALED DRAWING DIMENSIONS TO ARCHITECT BEFORE PROCEEDING WITH THE WORK.
13. ARCHITECT AND CONTRACTOR SHALL COORDINATE DOOR AND WINDOW OPENINGS AND INTERIOR AND EXTERIOR FINISHES.
14. DEMOLITION SHALL INCLUDE REMOVAL, TRANSPORT AND DISPOSAL OF ALL WASTE MATERIAL RELATED TO THE CONSTRUCTION OF THE PROJECT TO AN APPROVED FACILITY.

B. DESIGN LOADS

LIVE LOADS :
- ROOF ..... 20 PSF
- OFFICE ..... 50 PSF
- STAIRS/CORRIDORS ..... 100 PSF
- CORRIDORS ..... 100 PSF
- BALCONY ..... 60 PSF

DEAD LOADS :
- ROOF ..... 15 PSF
- FLOOR (WOOD) ..... 20 PSF

SNOW LOADS:
- GROUND ..... 15 PSF

WIND LOADS:
- ULTIMATE WIND SPEED ..... 115 MPH

1. ALL STRUCTURAL ELEMENTS DESIGNED TO SUSTAIN SPECIFIED DEAD AND LIVE LOADS IN COMBINATION SO AS TO PRODUCE THE MOST CRITICAL CONDITIONS.
2. PRE-ENGINEERED SYSTEMS AND COMPONENTS SHALL BE DESIGNED BASED ON THE MINIMUM LOAD REQUIREMENT PER ASCE-7 AND THE ABOVE BASIC LOAD PARAMETERS.
3. WHERE CONFLICTS OCCUR BETWEEN NOTES OR DRAWINGS, THE CONTRACTOR SHALL NOT PROCEED WITH THE AFFECTED WORK UNTIL THE STRUCTURAL ENGINEER ISSUES A CLARIFICATION.
4. THE STRUCTURAL CONTRACT DRAWINGS SHALL NOT BE USED AS TEMPLATES FOR SHOP DRAWINGS UNLESS EXPLICIT APPROVAL IS PROVIDED BY THE STRUCTURAL ENGINEER IN ADVANCE OF ANY SUBMITTALS. SUBMITTALS RECEIVED THAT HAVE USED THE DRAWINGS WITHOUT APPROVAL WILL BE REJECTED WITHOUT REVIEW.

C. FOOTINGS / FOUNDATIONS

1. FOUNDATION DESIGN IS BASED ON A PRESUMPTIVE ALLOWABLE SOIL BEARING PRESSURE OF 2000 PSF.
2. PRIOR TO CONSTRUCTION, SUB GRADE CONDITIONS USED AS DESIGN PARAMETERS SHALL BE TESTED AND EVALUIATED BY A GEOTECHNICAL ENGINEER LICENSED IN NORTH CAROLINA. ALLOW STRUCTURAL ENGINEER TO REVIEW GEOTECHNICAL REPORT PRIOR TO CONSTRUCTION.
3. FOUNDATION CONDITIONS DIFFERENT TO DESIGN PARAMETERS OR TO THE GEOTECHNICAL REPORT SHALL BE REPORTED TO THE STRUCTURAL AND GEOTECHNICAL ENGINEER BEFORE FURTHER CONSTRUCTION IS ATTEMPTED.
4. THE DESIGN EXCLUDES GLOBAL STABILITY OR ANY OTHER GROUND CONDITIONS. COMPETENT, GLOBAL STABILITY, OR ANY OTHER SUB GRADE CONDITIONS SHALL BE DETERMINED BY A GEOTECHNICAL ENGINEER LICENSED IN NORTH CAROLINA.
5. IT SHALL BE THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO ENGAGE THE SERVICES OF A GEOTECHNICAL ENGINEER LICENSED IN THE STATE OF NORTH CAROLINA PRIOR TO AND DURING CONSTRUCTION AS REQUIRED BY LOCAL ORDINANCE IN AREAS DESIGNATED AS "STEEP SLOPE", "HIGH HAZARD OR MODERATE HAZARD" OR "HIGH ELEVATION OVERLAY DISTRICTS". THE GEOTECHNICAL ENGINEER SHALL PREPARE A REPORT DESCRIBING SUB-GRADE CONDITIONS, AND PERFORM GLOBAL STABILITY ANALYSIS AS REQUIRED BY LOCAL ORDINANCE. RECOMMENDATIONS BASED ON GEOTECHNICAL TESTING AND EVALUATION SHALL BE PRESENTED TO THE AUTHORITY HAVING JURISDICTION FOR REVIEW WITH THE PERMIT APPLICATION. PRIOR TO FINAL APPROVAL BY THE JURISDICTION HAVING AUTHORITY, THE GEOTECHNICAL ENGINEER SHALL PREPARE A REPORT CERTIFING THE DESIGN RECOMMENDATIONS WERE FOLLOWED DURING CONSTRUCTION.
6. IT SHALL BE THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO ENGAGE THE SERVICES OF THE STRUCTURAL ENGINEER OF RECORD TO CONDUCT SPECIAL INSPECTIONS DURING CONSTRUCTION OF SITE RETAINING WALLS AS REQUIRED BY LOCAL ORDINANCE.
7. THE BOTTOM OF ALL EXTERIOR FOOTINGS SHALL BE A MINIMUM OF 24" BELOW FINISHED GRADE, UNLESS OTHERWISE NOTED.
8. ALL FOOTINGS SHALL BEAR ON UNDISTURBED NATIVE SOIL OR ENGINEERED FILL PER GEOTECHNICAL ENGINEER SPECIFICATIONS.
9. THE GENERAL CONTRACTOR SHALL USE THE STRUCTURAL DRAWINGS TOGETHER WITH THE ARCHITECTURAL, CIVIL, MECHANICAL AND ELECTRICAL DRAWINGS TO LOCATE FOOTING STEPS, DEPRESSED SLABS, SLOPES, DRAINS, OUTLETS, RECESSES, OPENINGS, BOLT SETTINGS, SLEEVES, DIMENSIONS, ETC. ANY POTENTIAL CONFLICTS SHALL BE REPORTED IN WRITING TO THE ARCHITECT / ENGINEER (A/E) BEFORE PROCEEDING WITH THE WORK.
10. PRIOR TO BACKFILLING, ALL RETAINING WALLS, EXCEPT THOSE DESIGNATED AS CANTILEVERS, SHALL BE SHORED UNTIL RESTRAINING FLOOR FRAMING IS IN PLACE AND CONCRETE HAS CURED FOR A MINIMUM OF 14 DAYS.

D. CONCRETE AND REINFORCING STEEL

1. WORK SHALL CONFORM TO THE LATEST EDITIONS OF ACI SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS (ACI 301) AND BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE (ACI 318). CONCRETE SHALL HAVE THE FOLLOWING MINIMUM COMPRESSIVE STRENGTH (f'c) AT 28 DAYS:

FOOTINGS ..... 3000 PSI
INTERIOR SLAB ON GRADE ..... 3000 PSI
EXTERIOR SLABS AND WALKS ..... 4500 PSI
FOUNDATION WALLS ..... 3000 PSI

2. ALL EXTERIOR CONCRETE SHALL CONTAIN ENTRAINED AIR IN ACCORDANCE WITH ACI 318, TABLE 4.4.1.
3. CONCRETE REINFORCEMENT BARS SHALL CONFORM TO ASTM A615, GRADE 60. REINFORCEMENT DESIGNATED AS CONTINUOUS SHALL LAP 57 BAR DIAMETER UNLESS NOTED OTHERWISE
4. WELDED WIRE FABRIC (WWF) SHALL CONFORM TO ASTM A 1064, LATEST REVISION.
5. SUPPORT REINFORCING MATERIAL ON SUITABLE CHAIRS OR CEMENTITIOUS BLOCKS SO AS NOT TO DISPLACE DURING PLACEMENT OF CONCRETE.
6. PROVIDE 3" MINIMUM CONCRETE COVER TO REINFORCEMENT WHEN CONCRETE IS PLACED AGAINST EARTH, 1 1/2" MINIMUM COVER ELSEWHERE UNLESS OTHERWISE NOTED.
7. CONCRETE SHALL BE CURED FOR 7 DAYS OR CURED BY USING AN APPROVED MEMBRANE CURING COMPOUND.
8. THE CONTRACTOR SHALL VERIFY IN THE FIELD THE TYPE AND LOCATION OF ALL EMBEDDED ITEMS INCLUDING ANCHOR BOLTS, PIPES, SLEEVES, CONDUIT, ETC., PRIOR TO PLACING CONCRETE.
9. REINFORCEMENT NOT FULLY ENCASED BY CONCRETE SHALL BE EPOXY COATED.

E. MASONRY

1. DESIGN, MATERIAL AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH "BUILDING CODE REQUIREMENTS FOR CONCRETE MASONRY STRUCTURES" TMS 402/602-16.
2. ALL CONCRETE MASONRY UNITS SHALL BE HOLLOW CONCRETE UNITS OF ULTIMATE COMPRESSIVE STRENGTH OF 1500 PSI, GRADE N, ASTM C 90. MORTAR SHALL BE TYPE S, MEETING ASTM C 270.
3. LAP ALL REINFORCING STEEL 48 BAR DIAMETERS, OR 2'-0" MINIMUM AT SPLICES. REINFORCEMENT SHALL BE PLACED AT THE CENTER OF CELLS UNLESS INDICATED OTHERWISE IN THE DETAILS.WHEN REINFORCEMENT IS LOCATED ADJACENT TO A CELL FACE, PROVIDE 3/4" CLEARANCE AND SUPPORT REBAR IN PLACE WITH SPACERS OR POSITIONERS AS REQUIRED. SPLICE REINFORCEMENT AS INDICATED ONLY.
4. GROUT SHALL BE IN ACCORDANCE WITH ASTM C476, STANDARD SPECIFICATIONS FOR GROUT OF MASONRY OR 3000 PSI "PEA GRAVEL" CONCRETE PER SPECIFICATIONS.
5. ALL VERTICAL REINFORCING BARS SHALL BE ANCHORED IN THE FOOTING, THICKENED SLAB, BEAM OR LINTEL SUPPORTING THE WALL AT THE TOP AND BOTTOM WITH STANDARD HOOKS OR BENDS AND SHALL BE CONTINUOUS THROUGHOUT THE HEIGHT OF THE WALL, WITH LAP SPLICES OF AT LEAST 48 BAR DIAMETERS FOR GRADE 60 REINFORCING STEEL OR AT LEAST 40 BAR DIAMETERS FOR GRADE 40 REINFORCING STEEL. MEETING ASTM A615.
6. LAPPED BARS SHALL BE SECURED WITH WIRE TIES OR OTHER MEANS TO ENSURE THAT THE BAR IS NOT DISPLACED DURING GROUT PLACEMENT.
7. GROUT ALL CELLS CONTAINING VERTICAL REINFORCEMENT IN 5'-0" MAX LIFTS. ALIGNMENT OF CELLS ARE TO BE INSPECTED AND APPROVED PRIOR TO PLACEMENT OF GROUT.
8. GROUT ALL CELLS BELOW FINISHED GRADE.
9. PROVIDE HORIZONTAL JOINT REINFORCEMENT IN WALLS AT 16" O.C. VERTICALLY, U.O.N. IN ADDITION, INSTALL JOINT REINFORCING IN THE FIRST TWO MORTAR JOINTS ABOVE AND BELOW OPENINGS, EXTENDING AT LEAST 24" BEYOND THE OPENING. PROVIDE HORIZONTAL JOINT REINFORCEMENT IN PARAPETS AND FREE STANDING WALLS AT 8" O.C. LAP JOINT REINFORCEMENT 6" MINIMUM.
10. ALL PRECAST OR POURED LINTELS SHALL BE REINFORCED WITH TWO #4 TOP & BOTTOM BARS WITH #3 TIES @ 12" O.C. AT A MINIMUM AND HAVE A 16" MINIMUM MASONRY END BEARING.
11. MASONRY WORK SHALL BE INSPECTED IN ACCORDANCE WITH ACI 530 QUALITY ASSURANCE LEVEL B.

F. STRUCTURAL LUMBER

1. ALL STRUCTURAL LUMBER SHALL CONFORM TO THE MOST CURRENT APPLICABLE SPECIFICATIONS OF THE AMERICAN INSTITUTE OF TIMBER CONSTRUCTION.
2. ALL EXTERIOR SIMPSON STRONG-TIE CONNECTORS SHALL HAVE A MEDIUM LEVEL OF CORROSION RESISTANCE AT MINIMUM (E.G. "Z-MAX" OR "HDG" HOT DIPPED GALVANIZED). THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE COMPATIBILITY OF CORROSION RESISTANT COATED CONNECTORS WITH ALL FASTENERS AND PRESERVATIVE-TREATED WOOD MEMBERS IN CONTACT WITH CONNECTOR.
3. ALL ROOF SHEATHING SHALL BE 5/8" THICK APA RATED SHEATHING EXPOSURE 1 WITH #10 TEK SCREWS @ 3" O.C. AT EDGE OF SHEATHING AND #10 TEKS SCREWS @ 12" O.C. AT INTERMEDIATE MEMBERS.
4. ALL EXTERIOR WALLS SHEATHING (EXCEPT SHEAR WALLS) SHALL BE 15/32" THICK APA RATED SHEATHING EXPOSURE 1 ATTACHED TO 2x STUD WALLS WITH #10 TEK SCREWS @ 6" O.C. AT EDGE OF SHEATHING INCLUDING TOP AND BOTTOM PLATE AND #10 TEK SCREWS @ 12" O.C. AT INTERMEDIATE MEMBERS.
5. ALL SHEAR WALL SHEATHING SHALL BE 15/32" THICK APA STRUCTURAL 1 RATED SHEATHING EXPOSURE 1 ATTACHED TO 2x STUD WALL WITH #10 TEK SCREWS @ 3" O.C. AT EDGE OF SHEATHING INCLUDING TOP AND BOTTOM PLATE AND #10 TEK SCREWS @ 12" O.C. AT INTERMEDIATE MEMBERS.
6. CONNECTORS - PER SIMPSON STRONG-TIE COMPANY

G. PREFABRICATED STEEL TRUSSES

1. FURNISH WHERE INDICATED ON PLAN. TRUSSES SHALL BE DESIGNED IN ACCORDANCE WITH THE APPLICABLE PROVISIONS OF LATEST EDITION OF NATIONAL DESIGN SPECIFICATIONS FOR WOOD CONSTRUCTION (NDS) OF THE AMERICAN FOREST AND PAPER ASSOCIATION (AF & PA), AND DESIGN SPECIFICATIONS FOR METAL PLATE CONNECTED WOOD TRUSSES (ANSI/TPI 1) OF THE TRUSS PLATE INSTITUTE (TPI), AND CODE OF JURISDICTION.
2. MANUFACTURER TRUSSES IN THE CONFIGURATION SHOWN. MOISTURE CONTENT OF LUMBER SHALL BE NO GREATER THAN 19 PERCENT AT THE TIME OF FABRICATION.
3. DESIGN LOADS: ROOF TRUSSES
TOP CHORD DL = 27 PSF
TOP CHORD LL = 20 PSF
BTM CHORD DL = 10 PSF
BTM CHORD LL = 0 PSF
4. TRUSS SHOP DRAWINGS SHALL BE SUBMITTED TO ARCHITECT (AND/OR STRUCTURAL ENGINEER) FOR REVIEW AND SHALL INCLUDE A MINIMUM OF THE FOLLOWING INFORMATION:

a. SPAN, DEPTH OR SLOPE, AND SPACING OF TRUSSES
b. REQUIRED BEARING WIDTH
c. DESIGN LOADS
d. DESIGN STRESSES IN EACH MEMBER
e. CONCENTRATED LOADS AND THEIR POINTS OF APPLICATION
f. REACTIONS (INCLUDING LOCATION AND DIRECTION)
g. PLATE TYPE, THICKNESS/GAGE (20 GAGE, MIN), SIZE AND LOCATION AT EACH JOINT
h. LOAD ADJUSTMENT FACTORS
i. WIND AND SEISMIC CRITERIA
j. STEEL SIZE AND GAGE
k. LOCATION OF ANY REQUIRED CONTINUOUS LATERAL BRACING
l. CALCULATED DEFLECTION RATIO AND/OR MAX DEFLECTION FOR LIVE AND TOTAL LOAD
m. LOCATION OF JOINTS
n. CONNECTION REQUIREMENTS FOR: TRUSS-TO-TRUSS GIRDERS, TRUSS PLY-TO-PLY, AND FIELD SPLICES
o. SEAL AND REGISTRATION NUMBER OF A CIVIL OR STRUCTURAL ENGINEER, LICENSED IN STATE WHERE TRUSSES ARE TO BE INSTALLED, SHALL APPEAR ON EACH TRUSS DESIGN AND ON THE TRUSS LAYOUT PLAN PREPARED BY THE TRUSS MANUFACTURER OR FABRICATOR
5. TRUSSES SHALL BE HANDLED DURING FABRICATION, DELIVERY AND AT JOBSITE SO AS NOT TO BE SUBJECTED TO EXCESSIVE BENDING. TRUSSES SHALL BE UNLOADED ON SMOOTH GROUND TO AVOID LATERAL STRAIN. TRUSSES SHALL BE PROTECTED FROM DAMAGE THAT MIGHT RESULT FROM ON-SITE ACTIVITIES AND ENVIRONMENTAL CONDITIONS. PREVENT TOPPLING WHEN BANDING IS REMOVED. TRUSSES SHALL BE SET AND SECURED LEVEL AND PLUMB, AND IN CORRECT LOCATION. HANDLE DURING INSTALLATION IN ACCORDANCE WITH LATEST VERSION OF BUILDING COMPONENT SAFETY INFORMATION (BCSI 1) FROM TPI, AND ANSI/TPI 1. INSTALLATION SHALL BE CONSISTENT WITH GOOD WORKMANSHIP AND GOOD BUILDING PRACTICES AND SHALL BE RESPONSIBILITY OF TRUSS INSTALLER.
6. APPARENT DAMAGE TO TRUSSES, IF ANY, SHALL BE REPORTED TO MANUFACTURER PRIOR TO INSTALLATION. TRUSSES SHALL BE HELD IN CORRECT ALIGNMENT UNTIL SPECIFIED PERMANENT BRACING IS INSTALLED.
7. CUTTING AND ALTERING OF TRUSSES IS NOT PERMITTED. CONCENTRATED LOADS SHALL NOT BE PLACED ATOP TRUSSES UNTIL ALL SPECIFIED BRACING HAS BEEN INSTALLED AND DECKING IS PERMANENTLY NAILED IN PLACE. SPECIFICALLY AVOID STACKING FULL BUNDLES OF DECKING OR OTHER HEAVY MATERIALS ONTO UNSHEATHED TRUSSES.
8. OVERBUILD FRAMING SHALL BE GABLE END TYPE TRUSSES SPACED AT 24" ON CENTER. PLYWOOD ROOF SHEATHING SHALL BE INSTALLED ON SUPPORTING TRUSSES OR WOOD JOISTS PRIOR TO INSTALLING OVERBUILD FRAMING.
9. FURNISH AND INSTALL ONE HURRICANE ANCHOR AT EACH END OF EACH ROOF TRUSS, UNLESS OTHERWISE NOTED ON PLANS OR DETAILS.

H. COLD-FORMED STEEL FRAMING

1. ALL EXTERIOR CURTAIN WALL LIGHT GAGE STRUCTURAL STEEL MEMBERS SHALL BE FORMED FROM STEEL SECTIONS THAT CONFORM TO THE SPECIFICATIONS OF THE STEEL STUD MANUFACTURERS ASSOCIATION (SSMA).
2. ALL LIGHT GAGE STRUCTURAL STEEL MEMBERS SHALL HAVE A MINIMUM FY = 33 KSI, BE SPACED AT 16" O/C U.O.N., WITH GROSS SECTION PROPERTIES EQUAL TO OR EXCEEDING:

SSMA DESI	FY	DIMENSIONS	DESIGN THICK	A, IN2	IX, IN4	SX, IN3	RX, IN	IY, IN4	RY, IN
WALL STUDS:									
326S162-54	50KSI	3-5/8" X 1-5/8"	0.0566	0.422	0.873	0.482	1.438	0.154	0.605
600S162-54	50KSI	6" X 1-5/8"	0.0566	0.556	2.860	0.954	2.270	0.180	0.570
WALL TRACK:									
362T150-54	50KSI	3-5/8" X 1-1/2"	0.0566	0.374	0.823	0.431	1.483	0.080	0.462
600T150-54	50KSI	6" X 1-1/2"	0.0566	0.509	2.610	0.840	2.270	0.091	0.422
CANOPY ROOF FRAME AND JOISTS & TRACK:									
1000S162-54	50KSI	10" X 1-5/8"	0.0566	0.783	9.950	1.990	3.570	0.204	0.511
1000T150-54	50KSI	10" X 1-1/2"	0.0566	0.707	8.340	1.630	3.430	0.059	0.288
ROOF FRAMING AND MECH PLATFORM FLOOR: LIGHT GAGE TRUSSES									

3. FURNISH AND INSTALL CONTINUOUS MECHANICAL LATERAL BRACING AT 48" O/C OR AS REQUIRED BY THE STRUCTURAL WALL STUD MANUFACTURER, U.O.N. ON THE DRAWINGS.
4. FASTEN TRACK TO SLAB W/ TITAN 1/2" ø X 6" ANCHORS @ 32" O.C.
5. PROVIDE SIMPSON DTC DEFLECTION CLIPS WHERE SHOWN; INSTALL PER MANUF. SPECS.; TYP.

J. MISCELLANEOUS ITEMS

1. EPOXY FOR THE SETTING OF DOWELS OR ANCHOR BOLTS SHALL BE SIMPSON SET EPOXY ADHESIVE. AS MANUFACTURED BY SIMPSON STRONG TIE OR AN APPROVED EQUIVALENT. INSTALLATION OF THE DOWELS/ ANCHOR BOLTS SHALL BE PERFORMED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS.
2. GROUT FOR SETTING BEARING SURFACES SHALL BE NON-SHRINK
3. WALLS RETAINING EARTH, OTHER THAN WALLS DESIGNED AS CANTILEVERS, SHALL BE ADEQUATELY BRACED UNTIL CONCRETE FOR THE SUPPORTING SLABS HAS BEEN PLACED AND SUFFICIENTLY CURED.
4. UNLESS SPECIFICALLY SHOWN OR NOTED ON THE DRAWINGS, NO STRUCTURAL MEMBER SHALL BE CUT, NOTCHED, BORED, OR OTHERWISE WEAKENED WITHOUT THE PERMISSION OF THE STRUCTURAL ENGINEER

TYPICAL ABBREVIATIONS

A.B.	ANCHOR BOLT	H.S.	HEADED STUD
ADD'L.	ADDITIONAL	HSS	HOLLOW STRUCTURAL SECTION
ARCH'L.	ARCHITECTURAL	JST.	JOIST
BM.	BEAM	JT.	JOINT
B.P.	BASE PLATE	LT.	LIGHT
BRG.	BEARING	MAS.	MASONRY
BSMT.	BASEMENT	MAX.	MAXIMUM
BTM.	BOTTOM	MECH.	MECHANICAL
BTR.	BETTER	MANUF.	MANUFACTURER
C.I.P.	CAST IN PLACE	MIN.	MINIMUM
C.J.	CONTROL OR CONSTRUCTION JOINT	NOM.	NOMINAL
CLR.	CLEAR	N.T.S.	NOT TO SCALE
CMU	CONCRETE MASONRY UNIT	O.H.	OPPOSITE HAND
COL.	COLUMN	O.C.	ON CENTER
COMP.	COMPOSITE	P.C.	PRECAST OR PILE CAP
CONC.	CONCRETE	PL.	PLATE
CONST.	CONSTRUCTION	PREFAB.	PREFABRICATED
CONT.	CONTINUOUS	P.T.	PRESSURE TREATED
COORD.	COORDINATE	REF.	REFERENCE
DET.	DETAIL	REINF.	REINFORCEMENT
DIA.	DIAMETER	SECT.	SECTION
DWG	DRAWING	SIM.	SIMILAR
E.B.	EXPANSION BOLT	STD.	STANDARD
E.O.S.	EDGE OF SLAB	STL.	STEEL
E.O.W.	EDGE OF WALL	STRUCT.	STRUCTURAL
EQ.	EQUAL	SQ.	SQUARE
ELEV.	ELEVATION	T.O.S.	TOP OF SLAB / TOP OF STEEL
EXIST.	EXISTING	T.O.W.	TOP OF WALL
E.W.	EACH WAY	TRANS.	TRANSVERSE
F.F.	FINISHED FLOOR	TYP.	TYPICAL
FIN.	FINISH(ED)	U.O.N.	UNLESS OTHERWISE NOTED
FLR.	FLOOR	V.I.F.	VERIFY IN FIELD
FND.	FOUNDATION	VERT.	VERTICAL
FTG.	FOOTING	WF	WIDE FLANGE
GALV.	GALVANIZED	WOLM.	WOLMANIZED
H.C.	HOLLOW CORE	WT.	WEIGHT
HORIZ.	HORIZONTAL	W.W.F.	WELDED WIRE FABRIC
H.D.G.	HOT DIP GALVANIZED		

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NEW OPERATORS BUILDING FOR CATAWBA COUNTY LANDFILL

4017 ROCKY FORD RD, NEWTON, NC 28658

KEY PLAN

REVISION

NO.	DESCRIPTION	DATE

NORTH CAROLINA MEDLOCK & ASSOCIATES ENGINEERING, PA CERTIFICATE OF AUTHORIZATION

08-25-26

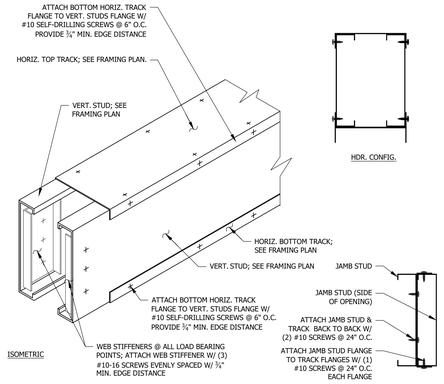
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038161 RICHARD K. MEDLOCK

DATE
08-25-26
ISSUE

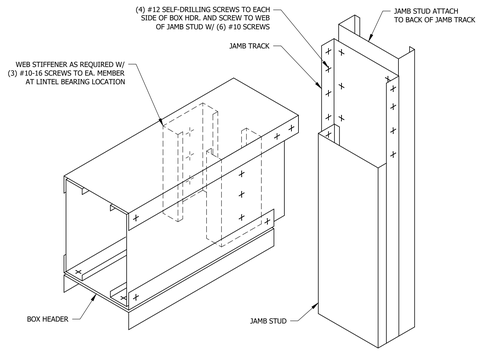
SHEET TITLE
APPENDIX 'B' & GENERAL STRUCTURAL NOTES

SHEET NO.
S001

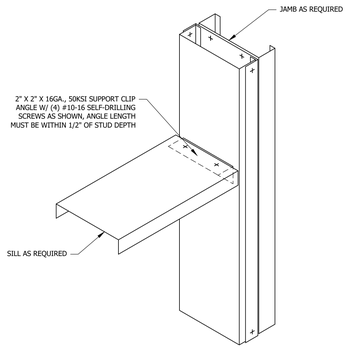
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TEMPLATE VERSION:



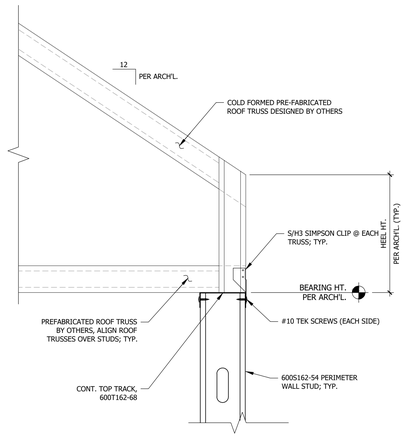
1 S002 L.G. HEADER DETAIL (TYP.)
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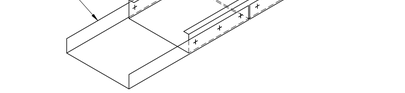
2 S002 L.G. HEADER BEARING (TYP.)
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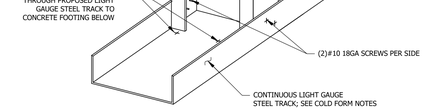
3 S002 LIGHT GAUGE FRAMING CLIP DETAIL (TYP.)
SCALE: 1-1/2"=1'-0"



4 S002 RAFTER CONNECTION DETAIL (TYP.)
SCALE: 1-1/2"=1'-0"



5 S002 TRACK SPLICE DETAIL (TYP.)
SCALE: 1-1/2"=1'-0"



6 S002 L.G. STUD TO TRACK DETAIL (TYP.)
SCALE: 1-1/2"=1'-0"

7 S002 STUD WALL BLOCKING DETAIL (TYP.)
SCALE: 1-1/2"=1'-0"



8 S002 BOX COLUMN DETAIL (TYP.)
N.T.S. (BOX HEADER SIMILAR)

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KEY PLAN

REVISION

NO.	DESCRIPTION	DATE

NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT — MEDLOCK & ASSOCIATES ENGINEERING, PA

08-25-26

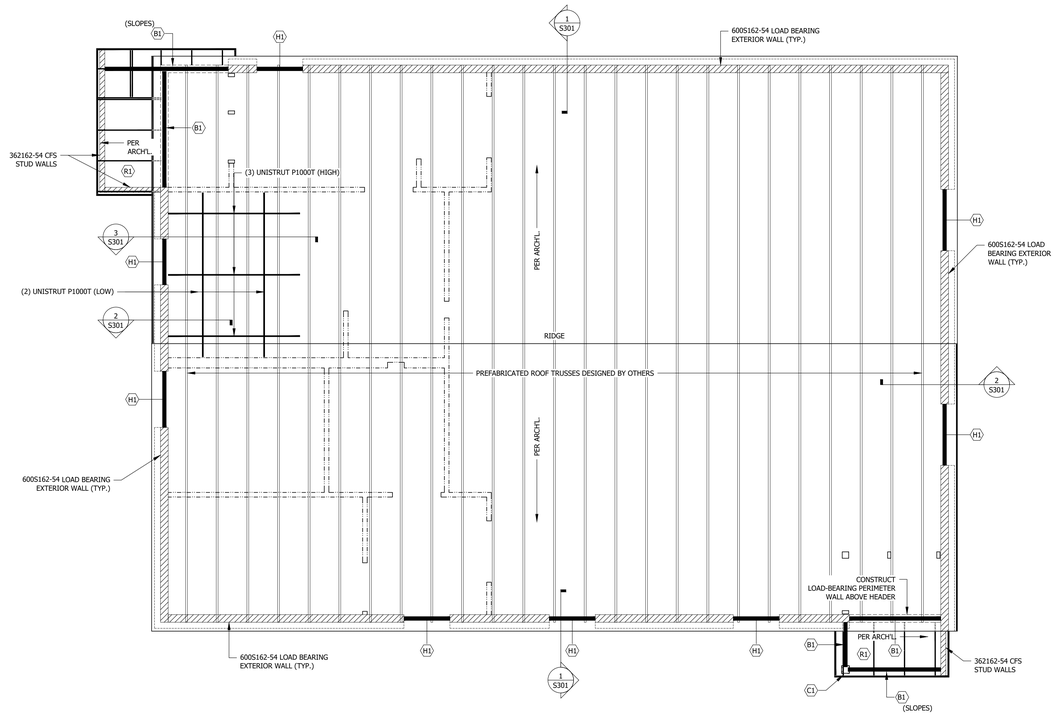
NORTH CAROLINA PROFESSIONAL ENGINEER — EDWARD K. MEDLOCK

DATE
08-25-26
ISSUE

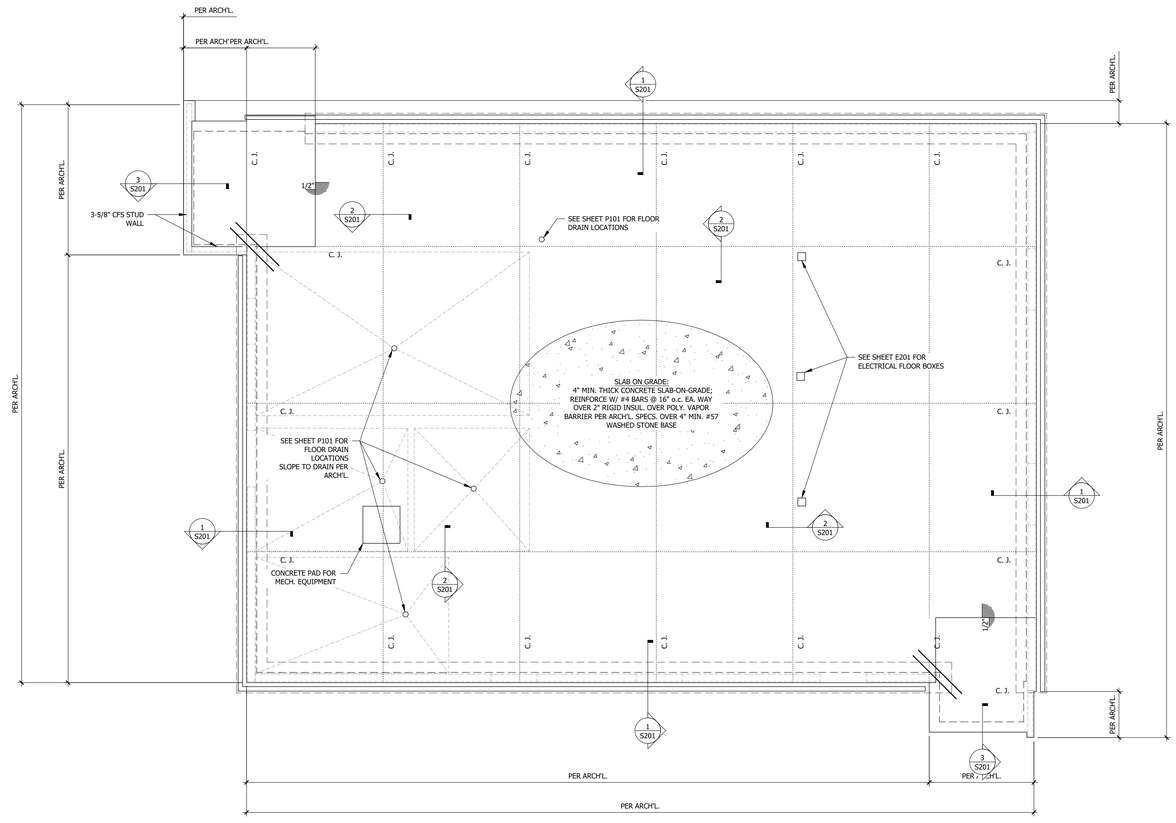
SHEET TITLE
TYPICAL LIGHT GAUGE FRAMING DETAILS

SHEET NO.
S002

MODEL: M:\PROJECTS\MAS\Catawba County Operator's Building\11 Construction Documentation\11 DWG\RVT\CatawbaCoOpsBldg.rvt
TEMPLATE VERSION:



2 S101 ROOF FRAMING PLAN
SCALE: 1/4"=1'-0"



1 S101 FOUNDATION PLAN
SCALE: 1/4"=1'-0"

FRAMING SCHEDULE

DESIGNATION	MEMBER SIZE	REMARKS
B1	1000S162-68 W/ 600T150-68 (BOX BEAM)	DET. 1/S002
C1	362S162-54 W/ 362T150-54 (BOX COLUMN)	DET. 8/S002
H1	HEADER 600S162-54 W/ 600T150-54 (BOX BEAM)	DET. 1/S002
R1	800S162-54 RAFTERS @ 16" O.C.	

FRAMING PLAN NOTES:

1. 'SW#' DENOTES PLYWOOD SHEARWALL. REFER TO SHEARWALL SCHEDULE SHEET S0.3.
2. 'HD' DENOTES SHEARWALL HOLD DOWN LOCATION, REFER TO SHEARWALL SCHEDULE ON SHEET S0.3.
3. 'ST' INDICATES SHEARWALL STRAPPING. SEE SCHEDULE S0.3
4. ALL PERIMETER LOAD-BEARING WALLS AND SHEAR WALLS STUDS ARE TO BE FULL HT.. AND SHALL BE BALLOON FRAMED FROM PLATE TO PLATE, THERE SHALL BE NO SPLICES AT CEILING JOISTS.
5. TYPICAL PERIMETER LOAD-BEARING EXTERIOR WALL STUDS SHALL BE 600S162-54 W/ 600T150-54 TRACK.
6. SEE ARCH'L. DRAWINGS FOR ALL WINDOW AND DOOR OPENING LOCATIONS AND REQ'D. ROUGH OPENING SIZES; TYP..
7. SEE ARCH'L. FOR INTERIOR PARTITION WALL TYPES AND LOCATIONS; U.O.N. TYP.
8. VERIFY ALL WALL PLATE ELEVATIONS WITH ARCH'L. DWG'S.

FOUNDATION & FRAMING PLAN LEGEND

HATCH	DESIGNATION	REMARKS
	CONCRETE SLAB ON GRADE	
	CMU FOUNDATION WALL, FILL ALL CELLS W/ 3000 PSI "PEA GRAVEL" CONCRETE	
	CAST-IN-PLACE CONCRETE FOUNDATION WALL	
	#2 SYP 2x STUD BEARING WALLS	

FOUNDATION PLAN NOTES:

1. VERIFY ALL T.O.F. ELEVATIONS IN THE FIELD.
2. ALL DIMENSIONS ARE TAKEN FROM FACE OF CONCRETE, EDGE OF SLAB-ON-GRADE OR TO CENTERLINE OF PIER/COLUMN. THE GENERAL CONTRACTOR IS RESPONSIBLE FOR VERIFYING & COORDINATING ALL DIMENSIONS W/ ARCH'L. DRAWINGS & DETAILS. NOTIFY THE ENGINEER OF RECORD OF ANY DISCREPANCIES OR INCONSISTENCIES. WORK SHALL NOT CONTINUE UNTIL ENGINEER HAS ISSUED A CLARIFICATION.
3. 'HD' INDICATES SHEAR WALL HOLD DOWN LOCATIONS, SEE SHEAR WALL SCHEDULE ON SHEET S0.3.
4. 'CJ' DENOTES CONTROL JOINT, SEE DETAIL ON SHEET S2.1.
5. STEP DENOTES STEP FOOTING, SEE TYPICAL FOOTING STEP DETAIL ON SHEET S2.1. STEP FOOTINGS W/ GRADE AS REQUIRED, LOCATIONS AND ELEVATIONS SHOWN ARE APPROXIMATE. THE GENERAL CONTRACTOR IS TO FIELD VERIFY FOOTING STEPS WITH FINAL STAMPED AND SEALED CIVIL GRADING DRAWINGS.
6. SEE DETAILS ON SHEET S.X.X FOR REFERENCED COLUMN BASEPLATES.
7. PROVIDE SAWCUT CONTROL JOINTS IN CONCRETE SLAB-ON-GRADE AS REQ'D. OR SHOWN, SPACE JOINTS (IN FEET) 2-3 TIMES THE SLAB THICKNESS (IN INCHES). LOCATE JOINTS TO AVOID RE-ENTRANT CORNERS.

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NEW OPERATORS BUILDING FOR CATAWBA COUNTY LANDFILL

4017 ROCKY FORD RD, NEWTON, NC 28658

KEY PLAN

REVISION

NO.	DESCRIPTION	DATE

NORTH CAROLINA REGISTERED PROFESSIONAL ENGINEER SEAL 043155 RICHARD K. MEDLOCK

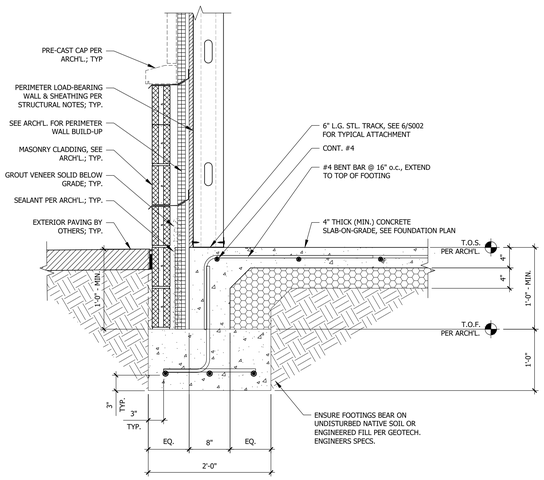
08-25-26

DATE
08-25-26
ISSUE

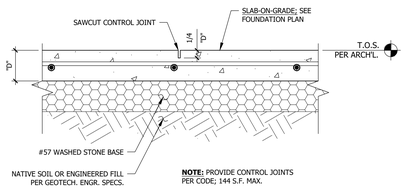
SHEET TITLE
FOUNDATION & ROOF FRAMING PLANS

SHEET NO.
S101

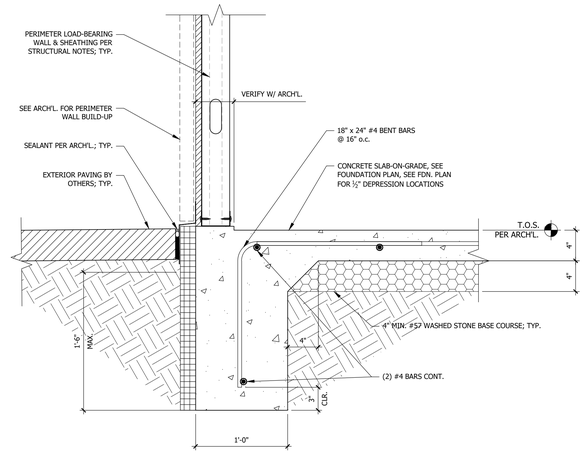
MODEL: M:\PROJECTS\McGill\Catawba County Operator's Building\11 Construction Documentation\11 1 DWG-RVT\CatawbaCoOpsBldg.rvt
TEMPLATE VERSION:



1 S201 FOOTING DETAIL
SCALE: 1"=1'-0"



2 S201 SAWCUT CONTROL JOINT DETAIL (TYP.)
SCALE: 1-1/2"=1'-0"



3 S201 TURN DOWN SLAB EDGE DETAIL
SCALE: 1-1/2"=1'-0"

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KEY PLAN

REVISION

NO.	DESCRIPTION	DATE

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08-25-26

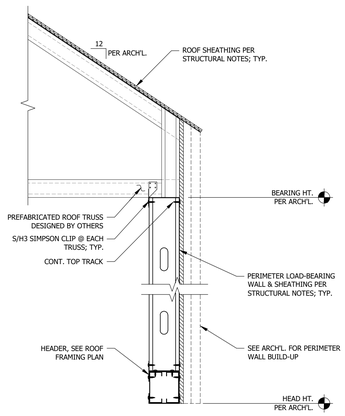
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL — RICHARD K. MEDLOCK

DATE
08-25-26
ISSUE

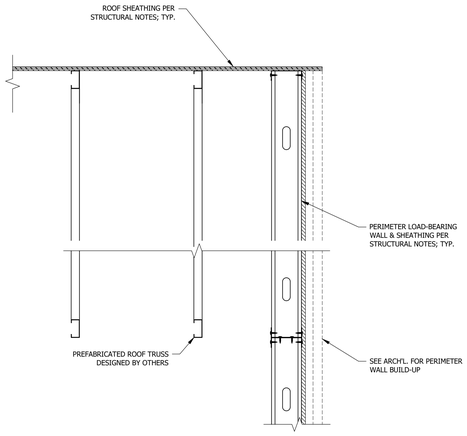
SHEET TITLE
FOUNDATION SECTIONS & DETAILS

SHEET NO.
S201

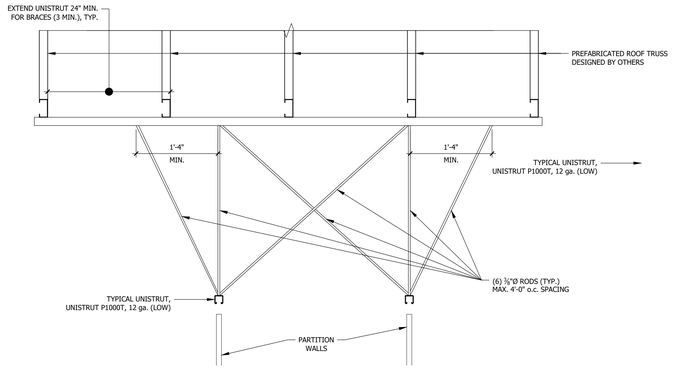
TEMPLATE VERSION:
MODEL: M:\PROJECTS\McGill\Catawba County Operator's Building\11 Construction Documentation\11.1 DWG-RVT\CatawbaCoOpsBldg.rvt



1 S301 ROOF FRAMING DETAIL
N.T.S.



2 S301 ROOF FRAMING DETAIL
N.T.S.



3 S301 PARTITION FRAMING SECTION
N.T.S.

MASTERS
ARCHITECTURE PLLC
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MEDLOCK & ASSOCIATES ENGINEERING, PA
53 Ashland Avenue
Suite 101
Asheville, NC 28801
Phone: 828-575-9498
Fax: 828-575-9499
Cert.#: C3133
STRUCTURAL • CONSULTING • CONSTRUCTION ASSISTANCE

NEW OPERATORS BUILDING FOR
CATAWBA COUNTY LANDFILL
4017 ROCKY FORD RD, NEWTON, NC 28658

KEY PLAN

REVISION

NO.	DESCRIPTION	DATE

NORTH CAROLINA
MEDLOCK & ASSOCIATES ENGINEERING, PA
CERTIFICATE # C-3133

08-25-26

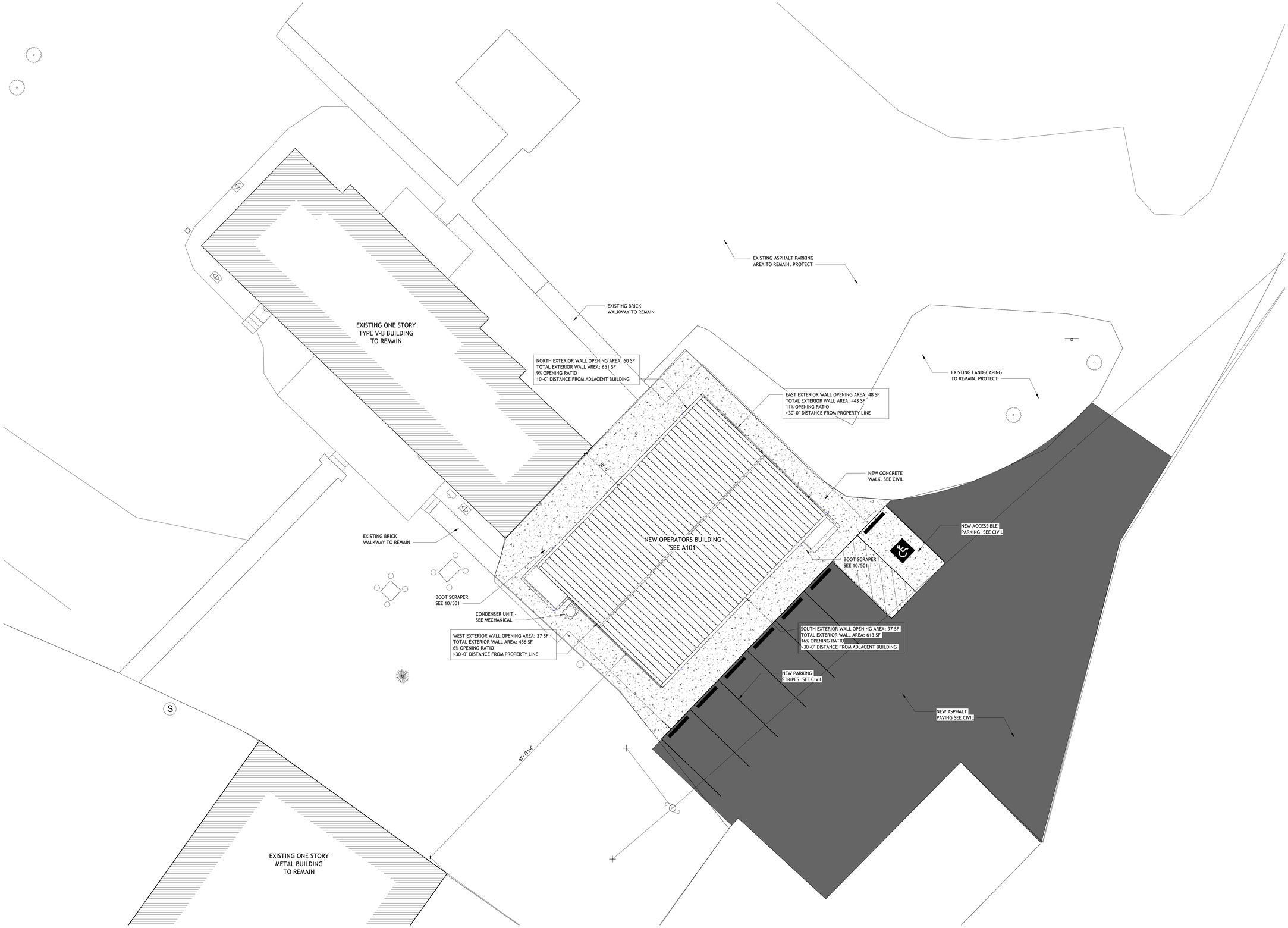
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL
RICHARD K. MEDLOCK

DATE
08-25-26
ISSUE

SHEET TITLE
FOUNDATION SECTIONS & DETAILS

SHEET NO.
S301

TEMPLATE VERSION:
MODEL: M:\PROJECTS\McGill\Catawba County Operator's Building\11 Construction Documentation\11.1 DWG-RVT\CatawbaCoOpsBldg.rvt



1 ARCHITECTURAL SITE PLAN
1/8" = 1'-0"

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CATAWBA COUNTY LANDFILL
4017 ROCKY FORD RD, NEWTON, NC 28658

MASTERS ARCHITECTURE, PLLC
REGISTERED ARCHITECTURAL CORPORATION
CERT. NO. 53428
NORTH CAROLINA
ASHEVILLE, NC

MARK ALEXANDER MASTERS
REGISTERED ARCHITECT
7193
NORTH CAROLINA
ASHEVILLE, NC

REVISION

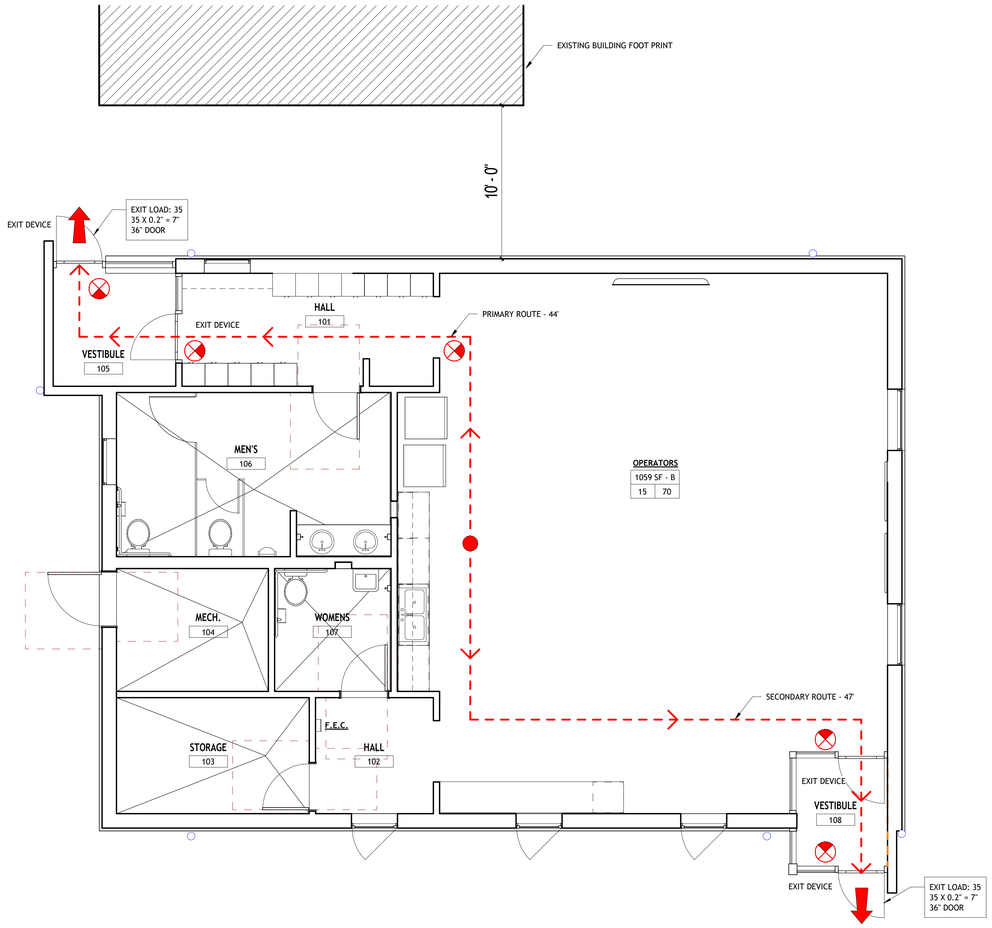
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DATE
08/25/26
ISSUE

SHEET TITLE
ARCHITECTURAL SITE PLAN

SHEET NO.
AS101

MODEL: M:\PROJECTS\MA\CIR\Catawba County Operator's Building\11 Construction Documentation\11 1 DWG-RVT\Catawba%20Ops%20Bldg977328.rvt
TEMPLATE VERSION:



1 LIFE SAFETY PLAN
1/4" = 1'-0"

SYMBOL LEGEND

F.E.C. — FIRE EXTINGUISHER CABINET

EXIT LIGHT

EXIT DISCHARGE TO EXTERIOR

ROOM NAME (OCCUPANCY)
AREA SF - B
OLF | OL

ROOM LABEL

LIFE SAFETY PLAN NOTES:

FIRE AND/OR SMOKE RATED WALLS:	NONE
ASSUMED AND REAL PROPERTY LINES:	SEE AS-101
EXTERIOR WALL OPENING AREA WITH RESPECT TO DISTANCE TO ASSUMED PROPERTY LINES (705.8):	SEE AS-101
OCCUPANCY USE FOR EACH AREA AS IT RELATES TO OCCUPANT LOAD CALCULATION (TABLE 1004.1.2):	SEE 1/-
OCCUPANT LOADS FOR EACH AREA:	SEE 1/-
EXIT ACCESS TRAVEL DISTANCES (1017):	SEE 1/-
COMMON PATH OF TRAVEL DISTANCES (TABLES 1006.2.1 & 1006.3.2(1)):	SEE 1/-
DEAD END LENGTHS (1020.4):	N/A
CLEAR EXIT WIDTHS FOR EACH EXIT DOOR:	SEE 1/-
MAXIMUM CALCULATED OCCUPANT LOAD CAPACITY EACH EXIT DOOR CAN ACCOMMODATE BASED ON EGRESS WIDTH (1005.3):	SEE 1/-
ACTUAL OCCUPANT LOAD FOR EACH EXIT DOOR:	SEE 1/-
A SEPARATE SCHEMATIC PLAN INDICATING WHERE FIRE RATED FLOOR/CEILING AND/OR ROOF STRUCTURE IS PROVIDED FOR PURPOSES OF OCCUPANCY SEPARATION:	N/A
LOCATION OF DOORS WITH PANIC HARDWARE (1010.1.10):	SEE 1/-
LOCATION OF DOORS WITH ELECTROMAGNETIC EGRESS LOCKS (1010.1.9.9):	SEE 1/-
LOCATION OF DOORS EQUIPPED WITH HOLD-OPEN DEVICES:	N/A
LOCATION OF EMERGENCY ESCAPE WINDOWS (1030):	N/A
THE SQUARE FOOTAGE OF EACH FIRE AREA (202):	N/A
THE SQUARE FOOTAGE OF EACH SMOKE COMPARTMENT FOR OCCUPANCY CLASSIFICATION I-2 (407.5):	N/A
NOTE ANY CODE EXCEPTIONS OR TABLE NOTES THAT MAY HAVE BEEN UTILIZED REGARDING THE ITEMS ABOVE:	

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MARK ALEXANDER MASTERS — REGISTERED ARCHITECT — 7193 — NORTH CAROLINA — ASHEVILLE, NC

REVISION

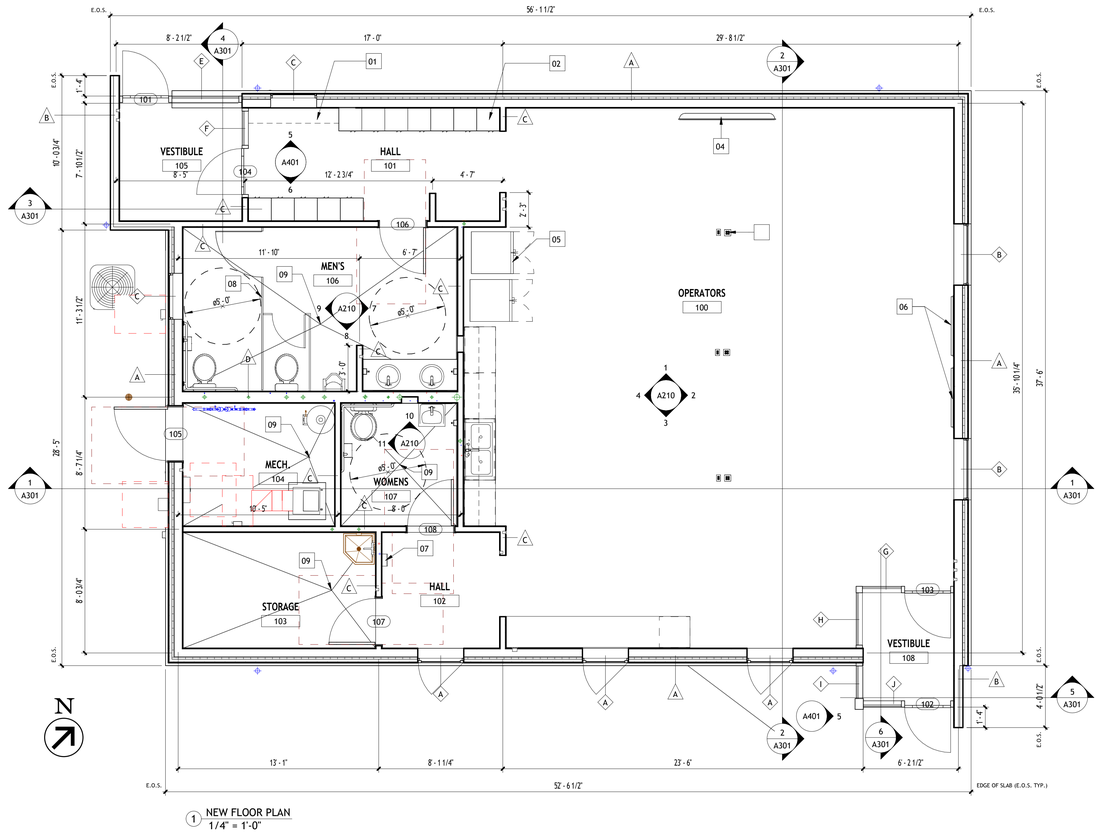
NO.	DESCRIPTION	DATE

DATE
08/25/26
ISSUE

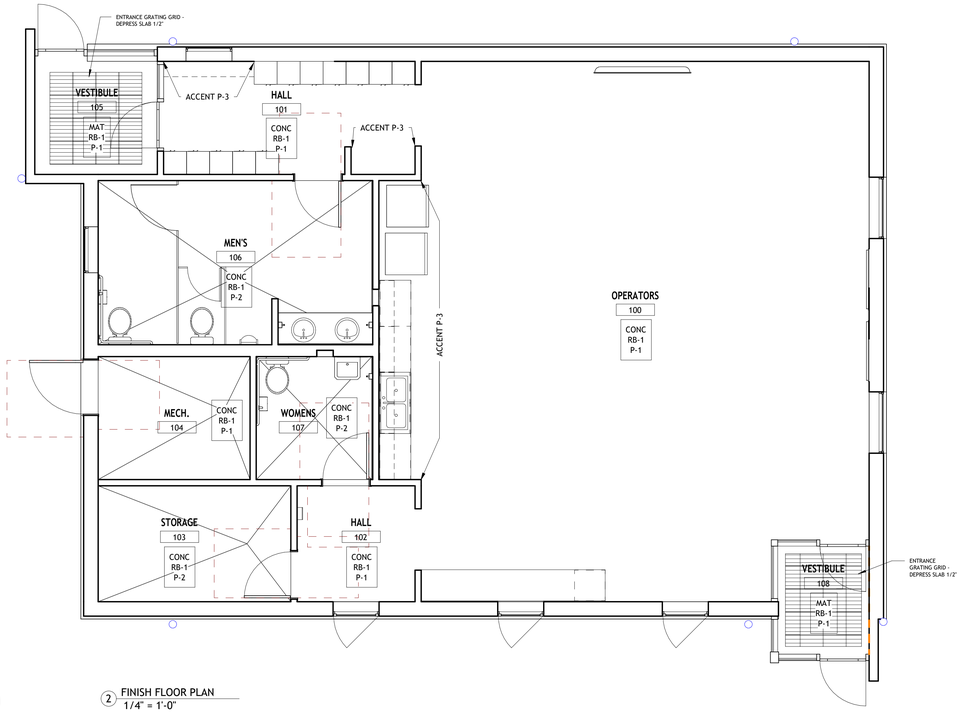
SHEET TITLE
LIFE SAFETY PLAN

SHEET NO.
A100

MODEL M:\PROJECTS\BASIS\Catawba County Operator's Building\11 Construction Documentation\11 DWG\RVT\CatawbaCoOpsBldg2071326.rvt
TEMPLATE VERSION



1 NEW FLOOR PLAN
1/4" = 1'-0"



2 FINISH FLOOR PLAN
1/4" = 1'-0"

KEYNOTE LEGEND	
KEY VALUE	KEYNOTE TEXT
01	WOODEN SHELF & COAT RACK. MOUNT PER 7/A501
02	(12) EXISTING LOCKERS 18"W X 18"D X 6'-6"H, OFCI. MOUNT PER 6/A501
04	80" TV, OFCI. CONTRACTOR TO COORDINATE & PROVIDE ALL BLOCKING, ELECTRICAL & AV REQUIREMENTS. SEE ELECTRICAL DRAWINGS
05	(2) REFRIGERATORS, OFCI. CONTRACTOR TO COORDINATE & PROVIDE ALL BLOCKING, ELECTRICAL & WATER REQUIREMENTS. SEE ELECTRICAL DRAWINGS
06	MARKER BOARD & TACK BOARD, OFCI. CONTRACTOR TO COORDINATE & PROVIDE BLOCKING.
07	FIRE EXTINGUISHER CABINET. MOUNT PER 11/501
08	CEILING HUNG TOILET PARTITIONS. SEE STRUCTURAL DRAWINGS AND 8/A501
09	FLOOR SLOPES 1/4":1'-0" TO FLOOR DRAIN. SEE PLUMBING & STRUCTURAL DRAWINGS AND 9/A501

GENERAL NOTES

1. THE AIA DOCUMENT, A201 GENERAL CONDITIONS OF THE CONTRACT, LATEST EDITION ARE HEREBY MADE A PART OF THESE CONTRACT DOCUMENTS. COPIES CAN BE OBTAINED FROM THE ARCHITECT IF NEEDED.
2. THE CONTRACT DOCUMENTS CONSIST OF THE OWNER/CONTRACTOR AGREEMENT, GENERAL NOTES AND SPECIFICATIONS, CONSTRUCTION DRAWINGS AND ANY SUBSEQUENTLY ISSUED ADDENDUM OR CHANGE ORDERS. THESE DOCUMENTS REPRESENT COOPERATIVE AND CONTINUOUS WORK INDICATED OR REASONABLY IMPLIED IN ANY ONE OF THOSE DOCUMENTS SUPPLIED SHALL BE AS THOUGH FULLY COVERED IN ALL. ANY DISCREPANCY BETWEEN THE DIFFERENT PARTS SHOULD BE REPORTED TO THE ARCHITECT IMMEDIATELY.
3. ALL WORK SHALL COMPLY WITH ALL STATE AND LOCAL CODES AND ORDINANCES. ALL WORK SHALL BE PREFORMED TO THE HIGHEST STANDARDS OF CRAFTSMANSHIP BY JOURNEYMEN OF THE APPROPRIATE TRADES.
4. THESE DOCUMENTS ARE INTENDED TO INCLUDE ALL LABOR, MATERIALS, EQUIPMENT AND SERVICES REQUIRED TO COMPLETE ALL WORK DESCRIBED HEREIN. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO BRING TO THE ATTENTION OF THE ARCHITECT ANY CONDITIONS WHICH WILL NOT PERMIT CONSTRUCTION ACCORDING TO THE INTENTIONS OF THESE DOCUMENTS. IT IS THE RESPONSIBILITY OF THE ARCHITECT TO PROVIDE DETAILS AND/OR DIRECTIONS REGARDING DESIGN INTENT WHERE IT IS ALTERED BY EXISTING CONDITIONS OR WHERE NEGLECTED IN THE DOCUMENTS.
5. ANY MATERIALS PROPOSED FOR SUBSTITUTION OF THOSE SPECIFIED OR CALLED OUT BY TRADE NAME IN THESE DOCUMENTS SHALL BE PRESENTED TO THE ARCHITECT FOR REVIEW. THE CONTRACTOR SHALL SUBMIT SAMPLES WHEN REQUIRED BY THE ARCHITECT AND ALL SUCH SAMPLES SHALL BE REVIEWED BY THE ARCHITECT BEFORE THE WORK IS TO BE PERFORMED. WORK MUST CONFORM TO THE REVIEWED SAMPLES. ANY WHICH DOES NOT CONFORM TO THE REVIEWED SAMPLES SHALL BE REMOVED AND REPLACED WITH WORK WHICH CONFORMS AT THE EXPENSE OF THE CONTRACTOR. SUBCONTRACTORS SHALL SUBMIT REQUESTS AND SAMPLES FOR REVIEW THROUGH THE GENERAL CONTRACTOR WHEN WORK IS LET THROUGH THE GENERAL CONTRACTOR. REQUIRED VERIFICATIONS AND SUBMITTALS ARE TO BE MADE IN ADEQUATE TIME AS NOT TO DELAY WORK IN PROGRESS.
6. SHOP DRAWINGS SHALL BE SUBMITTED TO THE ARCHITECT FOR REVIEW WHERE CALLED FOR ANYWHERE WITHIN THESE CONTRACT DOCUMENTS. REVIEW SHALL BE MADE BY THE ARCHITECT BEFORE THE WORK IS BEGUN AND WORK SHALL CONFORM TO THE REVIEWED SHOP DRAWINGS AND IS SUBJECT TO REPLACEMENT AS SET FORTH IN PARAGRAPH #5 ABOVE.
7. THE BUILDING INSPECTOR SHALL BE NOTIFIED BY THE CONTRACTOR WHEN THERE IS A NEED FOR INSPECTION AS REQUIRED BY STATE AND LOCAL CODES OR ORDINANCES.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SAFETY AND CARE OF ADJACENT PROPERTIES AND PROJECT SITES DURING CONSTRUCTION, FOR COMPLIANCE WITH FEDERAL AND STATE O.S.H.A. REGULATIONS AND FOR THE PROTECTION OF ALL WORK UNTIL IT HAS BEEN DELIVERED TO THE OWNER AND THE CONTRACTOR HAS VACATED THE PROPERTY.
9. DRAWINGS SHALL NOT BE SCALED. DIMENSIONS WITH "N.T.S." INDICATES THAT THE DRAWING IS NOT TO SCALE.
10. THE CONTRACTOR SHALL VERIFY AND COORDINATE ALL OPENINGS THROUGH FLOORS, CEILINGS AND WALLS WITH ALL ARCHITECTURAL, STRUCTURAL MECHANICAL, PLUMBING AND ELECTRICAL DRAWINGS.
11. WORK TO OCCUR IN THE OCCUPIED AREA OF WORK AND/OR THE SHUT-DOWN OF ANY UTILITIES WILL BE COORDINATED WITH AND DONE AT THE CONVENIENCE OF THE OWNER.
12. THE OCCUPED AREA OF WORK WILL BE CLEANED OF ALL CONSTRUCTION DUST, DIRT, DEBRIS, AND PROTECTIVE PLASTIC REMOVED FROM EQUIPMENT AFTER ANY WORK OCCURING DURING "OFF-HOURS" AND WEEKEND PRIOR TO HOURS OF BUSINESS OPERATIONS.
13. ALL EXISTING RETURN AIR VENTS WITHIN THE AREA OF WORK ARE TO BE COVERED WITH FILTER FABRIC DURING CONSTRUCTION.
14. ALL CONSTRUCTION METHODS, MATERIALS, AND SYSTEM INSTALLATION SHALL CONFORM TO ALL APPLICABLE LOCAL AND STATED REGULATION AND THE SPECIFICATIONS OF THE MANUFACTURERS,
15. THE ARCHITECT IS TO BE NOTIFIED IMMEDIATELY OF ANY WORK PERFORMED OR ITEMS WITHIN THE CONTRACT DOCUMENTS REJECTED BY THE LOCAL AND/OR STATE BUILDING AUTHORITY.
16. IT IS THE RESPONSIBILITY OF THE CONTRACTOR(S) TO VERIFY ALL EXISTING CONDITIONS PRIOR TO COMMENCING WORK. THE CONTRACTOR SHALL NOTIFY THE ARCHITECT OF ANY PREVIOUSLY UNKNOWN EXISTING CONDITIONS WHICH ARE NOT REFLECTED IN THE CONTRACT DOCUMENTS.
17. ALL AREAS OUTSIDE OF THE AREA OF WORK SHALL BE KEPT FREE FROM DUST, DIRT, AND DEBRIS DURING CONSTRUCTION. AREAS OUTSIDE OF THE AREA OF WORK SHALL NOT BE USED TO STORE TRASH, NEW MATERIALS OR TOOLS DURING THE DURATION OF THE CONTRACT. APPROPRIATE STAGING AREAS ARE TO BE COORDINATED WITH THE OWNER.
18. ALL ITEMS DESIGNATED TO BE REUSED OR RELOCATED SHALL BE CARED FOR IN A MANNER SUCH THAT THEY ARE RETURNED TO SERVICE IN GOOD CONDITION AND WORKING PROPERLY. ITEMS WHICH ARE DAMAGED DURING CONSTRUCTION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO REPAIR AND/OR REPLACE.
19. THE CONTRACTOR WILL NOTIFY THE ARCHITECT OF ANY NECESSARY PENETRATIONS THROUGH EXISTING STRUCTURAL WALLS TO ACCOMODATE PLUMBING, SPRINKLER, MECHANICAL, OR ELECTRICAL SYSTEMS WHICH ARE NOT NOTED WITHIN THE CONTRACT DOCUMENTS PRIOR TO PERFORMING THE WORK. ALL NEW OPENINGS AND PENETRATIONS IN WALLS WILL BE PATCHED AND REPAIRED TO MATCH THE EXISTING CONDITIONS.
20. THE CONTRACTOR IS TO COORDINATE THE INSTALLATION AND SEQUENCING OF ALL ARCHITECTURAL, STRUCTURAL, PLUMBING, SPRINKLER, MECHANICAL AND ELECTRICAL WORK.
21. THE INDICATED AREA OF WORK ON THE ARCHITECTURAL DRAWINGS MAY NOT BE INCLUSIVE OF AREAS OF WORK WHERE PLUMBING, SPRINKLER, MECHANICAL, AND ELECTRICAL WORK IS TO OCCUR. ALL DRAWINGS AND ITEMS WITHIN THE CONTRACT DOCUMENTS ARE TO BE REFERENCED AND WILL DETERMINE THE DEFINITIVE AREA(S) OF WORK. ALL GENERAL NOTES ARE APPLICABLE TO THE ENTIRETY OF THE AREA(S) OF WORK.
22. CONTRACTOR SHALL MAINTAIN ON SITE, AN EXTRA SET OF DRAWINGS AND SPECIFICATIONS FOR THE PURPOSE OF RECORDING CHANGES AND VARIATIONS DAILY, AS WELL AS ADDITIONAL INFORMATION SPECIFIED
23. NO SHOP DRAWINGS SHALL BE SUBMITTED FOR ARCHITECTURAL REVIEW UNTIL AFTER THEY HAVE BEEN REVIEWED AND NOTED FOR CONSTRUCTION METHOD, DIMENSIONING AND OTHER TRADE REQUIREMENTS BY THE CONTRACTOR AND STAMPED WITH THE CONTRACTOR'S APPROVAL SEAL. THE ARCHITECT ASSUMES NO RESPONSIBILITY FOR DIMENSIONS, QUANTITIES , ERRORS OR OMISSIONS AS A RESULT OF CHECKING AND REVIEWING ANY SHOP DRAWINGS. ANY ERRORS OR OMISSIONS SHALL BE RECTIFIED BY THE CONTRACTOR, IRRESPECTIVE OF RECEIPT, CHECKING OR REVIEW OF DRAWINGS BY ARCHITECT REGARDLESS IF WORK IS DONE IN ACCORDANCE WITH SUCH DRAWINGS.
24. ALL DIMENSIONS ARE TO CENTER OF STUD UNLESS NOTED OTHERWISE.
25. ALL FURNITURE & EQUIPMENT IS BY OWNER UNLESS OTHERWISE SPECIFIED
26. TO PROMOTE INWARD DRYING OF THE EXTERIOR WALL ASSEMBLY, ALL INTERIOR FINISHES APPLIED TO THE EXTERIOR WALL'S INTERIOR FACE MUST BE VAPOR PERMEABLE (GREATER THAN 1.0 PERMS). DO NOT APPLY VINYL WALL COVERINGS, OIL-BASED PAINTS, EPOXY PAINTS, FOIL-BACKED GYPSUM BOARD, OR OTHER VAPOR-IMPERMEABLE MATERIALS. STANDARD LATEX PRIMER AND LATEX PAINT ARE ACCEPTABLE.

Room Finish Schedule

Room Number	Room Name	Floor Finish	Base Finish	Wall Finish	Ceiling Finish	Ceiling Height	Comments
100	OPERATORS	SEALED CONCRETE	RUBBER	P-1	ACT-1	9' - 0"	
101	HALL	SEALED CONCRETE	RUBBER	P-1	ACT-1	8' - 0"	
102	HALL	SEALED CONCRETE	RUBBER	P-1	ACT-1	8' - 0"	
103	STORAGE	SEALED CONCRETE	RUBBER	P-2	GWB	12' - 0"	
104	MECH.	SEALED CONCRETE	RUBBER	P-1	GWB	12' - 0"	
105	VESTIBULE	ENTRACE MAT GRID	RUBBER	P-1	GWB	8' - 0"	
106	MEN'S	SEALED CONCRETE	RUBBER	P-2	GWB	8' - 0"	
107	WOMENS	SEALED CONCRETE	RUBBER	P-2	GWB	8' - 0"	
108	VESTIBULE	ENTRACE MAT GRID	RUBBER	P-1	GWB	8' - 0"	

INTERIOR FINISH LEGEND

WALLS/SOFFITS

P-1	WALL	
	MANUFACTURER:	SHERWIN WILLIAMS
	COLOR:	INCREDIBLE WHITE 7028
	SHEEN:	EGGSHELL
	NOTES:	OVERALL PAINT IN ALL AREAS UNLESS NOTED OTHERWISE
P-2	WET AREAS	
	MANUFACTURER:	SHERWIN WILLIAMS
	COLOR:	INCREDIBLE WHITE 7028
	SHEEN:	SEMI GLOSS
	NOTES:	WATER BASED EPOXY PAINT IN WET AREAS
P-3	ACCENT	
	MANUFACTURER:	SHERWIN WILLIAMS
	COLOR:	ADRIFT SW7608
	SHEEN:	SEMI GLOSS
	NOTES:	WATER BASED EPOXY PAINT IN WET AREAS
HM-1	DOOR FRAMES	
	MANUFACTURER:	SHERWIN WILLIAMS
	COLOR:	SAWGRASS BASKET SW 9121
	SHEEN:	SEMI GLOSS
	NOTES:	

CEILINGS

ACT-1	SEE R.C.P.	
	MANUFACTURER:	ARMSTRONG
	PATTERN:	DUNE
	COLOR:	WHITE
	SIZE:	24" X 24"

WALLS/SOFFITS

PL-1	CABINETS	
	TYPE:	PLASTIC LAMINATE
	MANUFACTURER:	FORMICA
	PATTERN/COLOR:	NATURAL WHITE OAK 9038
	NOTES:	--
PL-2	COUNTERTOPS	
	TYPE:	PLASTIC LAMINATE
	MANUFACTURER:	FORMICA
	PATTERN/COLOR:	ICE ONYX 7408
	NOTES:	--

BASE TRIM

RB-1	TYPE:	RUBBER COVE BASE
	MANUFACTURER:	TARKETT
	PATTERN/COLOR:	TA5 COLONIAL GREY
	SIZE:	4"

FLOORING

CONC	SEALED CONCRETE	
	NOTE:	SEAL CONCRETE PER SPECIFICATIONS
MAT	ENTRYWAY SYSTEM	
	MANUFACTURER:	MATWORKS
	COLLECTION	MATSHIELD PRO GRID SYSTEM 70152
	COLOR	BLACK
	NOTES:	WITH CARPET

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22 S. PACK SQ. SUITE 301, ASHEVILLE, NC 28801

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NEW OPERATORS BUILDING FOR

CATAWBA COUNTY LANDFILL

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REVISION

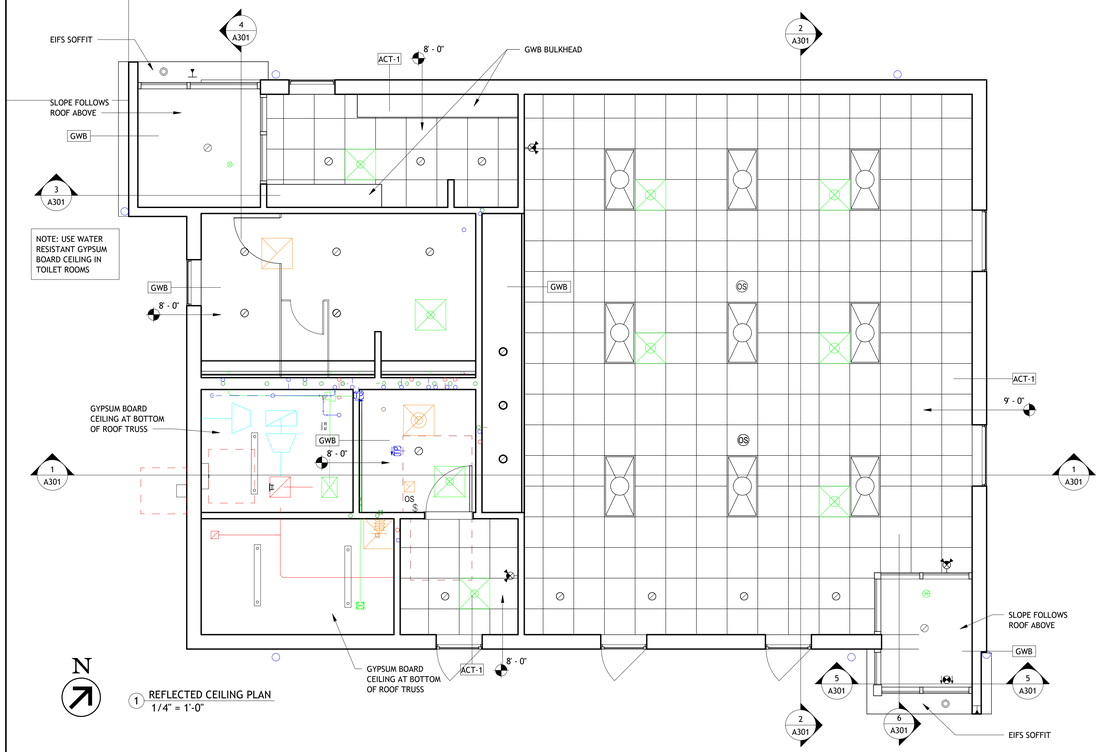
NO.	DESCRIPTION	DATE

DATE
08/25/26
ISSUE

SHEET TITLE
NEW FLOOR PLAN & FINISH PLAN

SHEET NO.
A101

MODEL: M:\PROJECTS\Master\Catawba County Operator's Building\211 Construction Documentation\11.1 DWG-RVT\Catawba-CoOpsBldg071526.rvt
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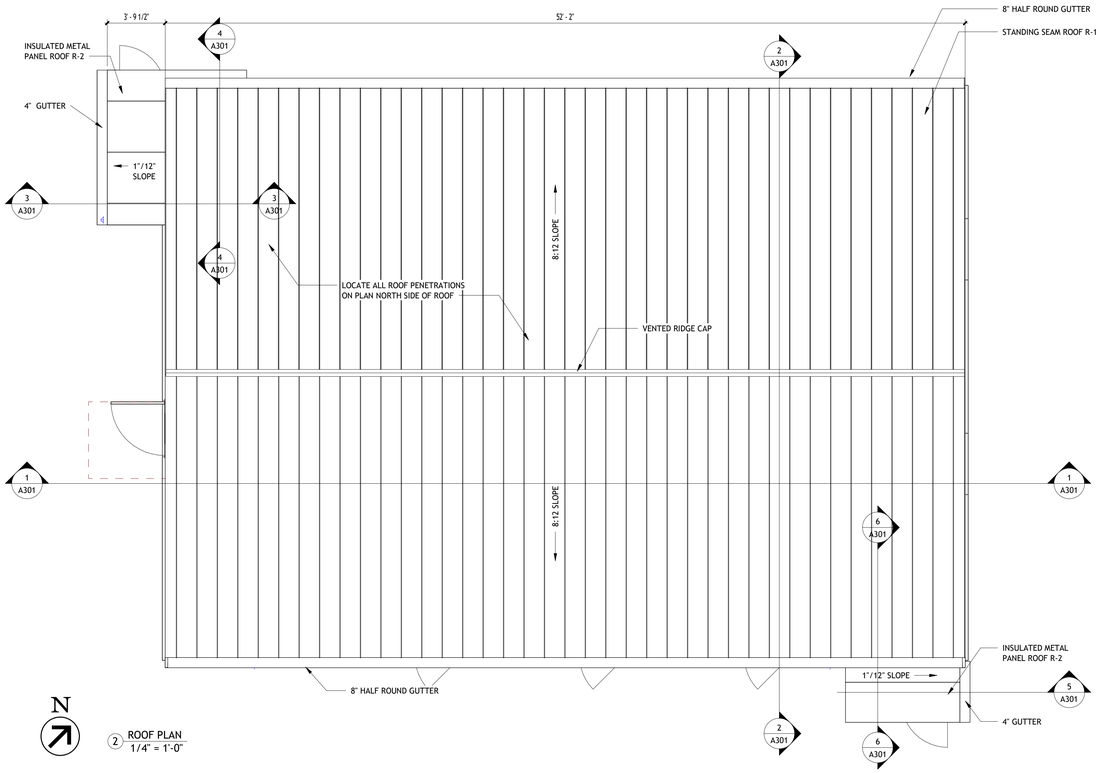


N

1 REFLECTED CEILING PLAN
1/4" = 1'-0"

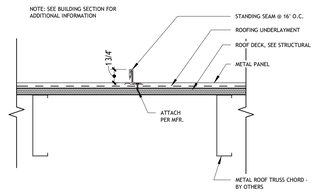
CEILING LEGEND

	SUPPLY DIFFUSER SEE MECHANICAL		RECESSED CAN LIGHT SEE ELECTRICAL
	RETURN REGISTER SEE MECHANICAL		2X4 RECESSED TROFFER SEE ELECTRICAL
	EXHAUST GRILLE SEE MECHANICAL		SHOP PENDANT LIGHT @ 9'-0" A.F.F. SEE ELECTRICAL
	SUPPLY DIFFUSER SEE MECHANICAL		

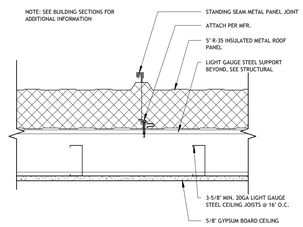


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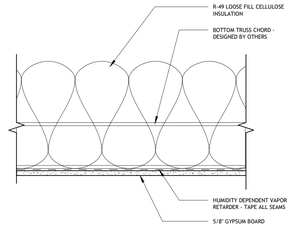
2 ROOF PLAN
1/4" = 1'-0"



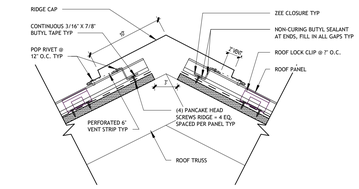
3 ROOF ASSEMBLY A
1 1/2" = 1'-0"



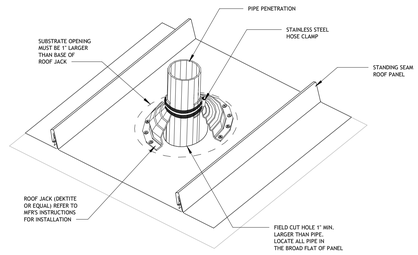
4 ROOF ASSEMBLY B
1 1/2" = 1'-0"



7 TRUSS CEILING ASSEMBLY
1 1/2" = 1'-0"



5 VENTED RIDGE CAP
1 1/2" = 1'-0"



6 ROOF PENETRATION
3" = 1'-0"

MArch MASTERS ARCHITECTURE PLLC
22 S. PACK SQ. SUITE 301, ASHEVILLE, NC 28801

NOTICE:
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mcgill

NEW OPERATORS BUILDING FOR CATAWBA COUNTY LANDFILL

4017 ROCKY FORD RD, NEWTON, NC 28658



REVISION

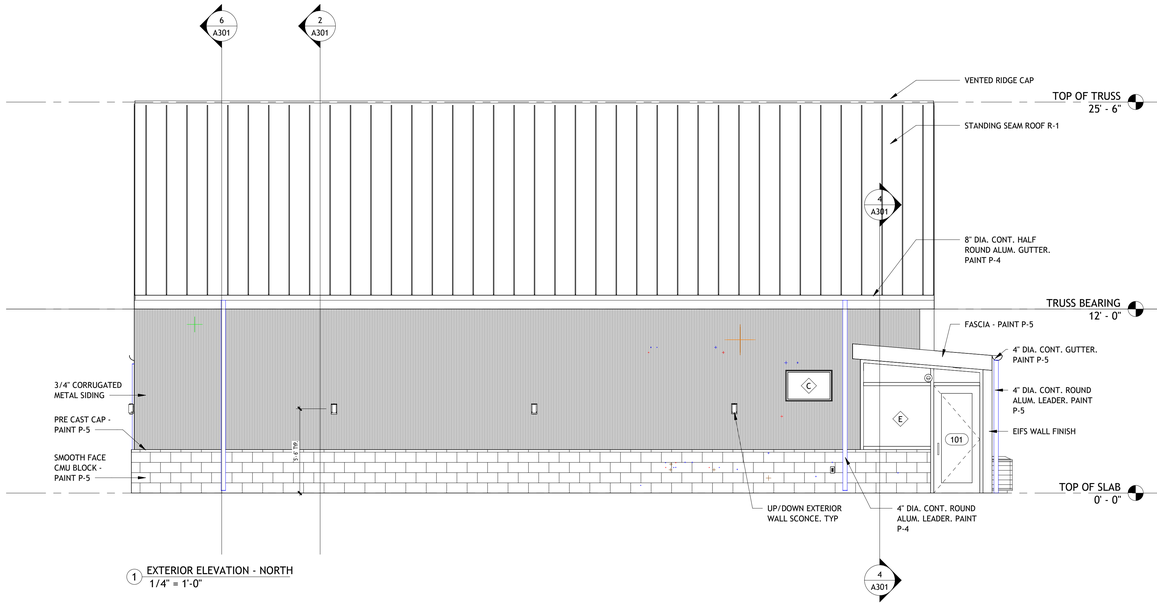
NO.	DESCRIPTION	DATE

DATE
08/25/26
ISSUE

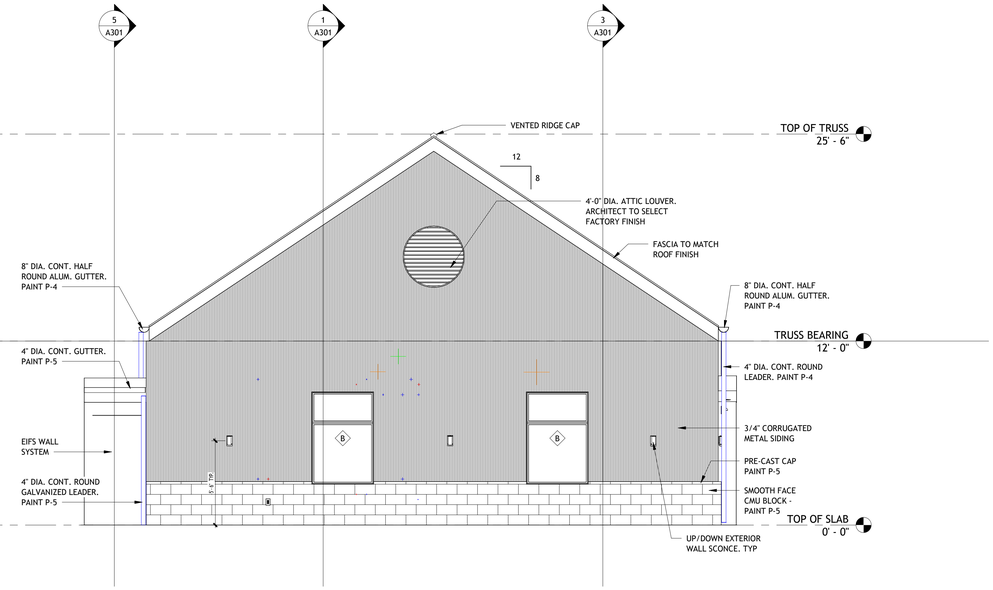
SHEET TITLE
REFLECTED CEILING PLAN & ROOF PLAN

SHEET NO.
A110

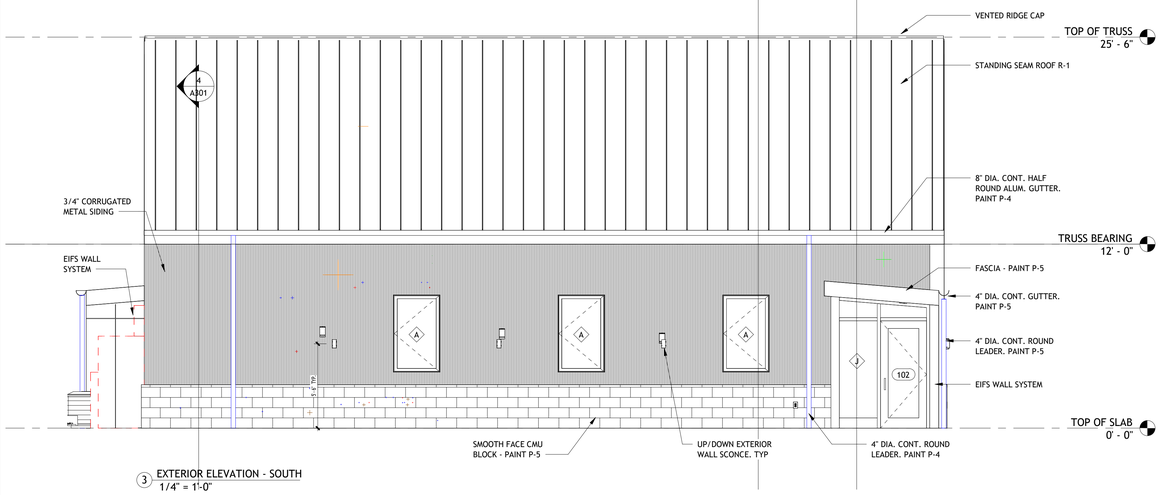
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TEMPLATE VERSION:



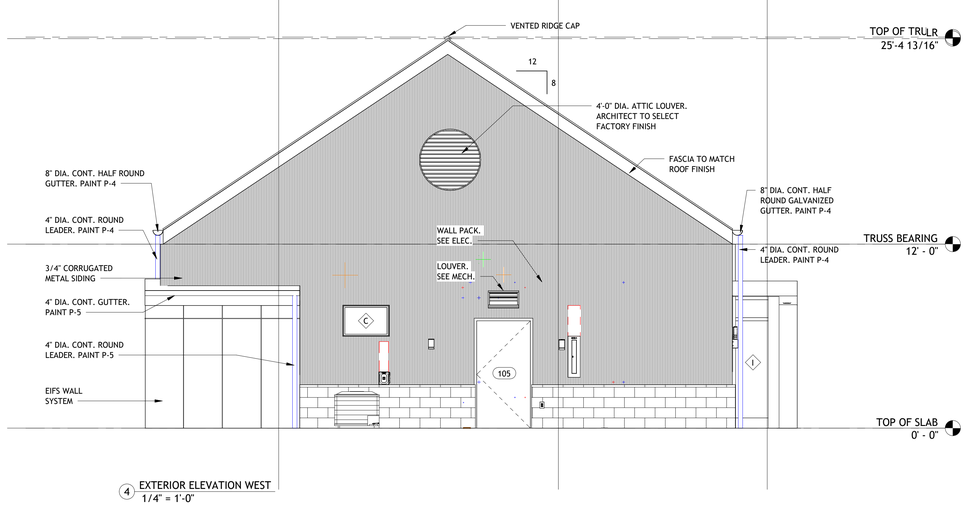
1 EXTERIOR ELEVATION - NORTH
1/4" = 1'-0"



2 EXTERIOR ELEVATION - EAST
1/4" = 1'-0"



3 EXTERIOR ELEVATION - SOUTH
1/4" = 1'-0"



4 EXTERIOR ELEVATION WEST
1/4" = 1'-0"

EXTERIOR FINISH LEGEND

EXTERIOR WALL FINISHES

CORRUGATED METAL SIDING	BASIS OF DESIGN	
	MANUFACTURER:	BEST BUY METALS
	MODEL:	3/4" CORRUGATED
	FINISH:	BUCKSKIN 26GA
	NOTES:	
EXTERIOR INSULATION & FINISH SYSTEM	BASIS OF DESIGN	
	MANUFACTURER:	DRYVIT
	MODEL	OUTSULATION LCMD
	FINISH	REFLECTIT TIN MAN SMOOTH
	NOTES:	

ROOF

R-1	STANDING SEAM	BASIS OF DESIGN
	MANUFACTURER:	BEST BUY METALS
	MODEL:	SNAP SEAM STANDING SEAM
	FINISH:	CHARCOAL 26 GA
	NOTES:	
R-2	INSULATED METAL PANEL	
	MANUFACTURER:	KINGSPAN
	MODEL:	KINGSEAM
	FINISH:	SANDSTONE
	NOTES:	

PAINTS & COATINGS

P-4	ACCENT	
	MANUFACTURER:	SHERWIN WILLIAMS
	COLOR:	PEPPERCORN SW7674
	SHEEN:	
	NOTES:	
P-5	WAINSCOTTING	
	MANUFACTURER:	SHERWIN WILLIAMS
	COLOR:	INCREDIBLE WHITE 7028
	SHEEN:	
	NOTES:	

NOTE: VERIFY ALL FINISHES WITH OWNER PRIOR TO ORDERING MATERIALS

MODEL: M:\PROJECTS\McGill\Catawba County Operator's Buildings\11 Construction Documentation\11.1 TOWD.RVT\Catawba CoOpsBldg071208.rvt
TEMPLATE VERSION:

MASTERS ARCHITECTURE PLLC
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NEW OPERATORS BUILDING FOR CATAWBA COUNTY LANDFILL

4017 ROCKY FORD RD, NEWTON, NC 28658



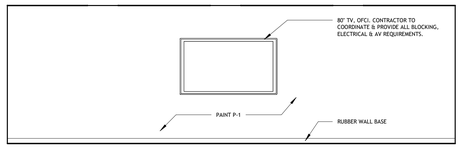
REVISION

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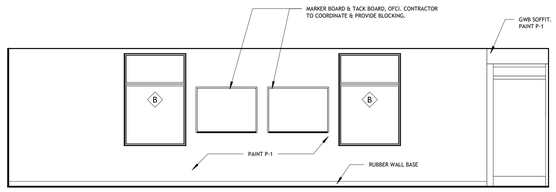
DATE
08/25/26
ISSUE

SHEET TITLE
EXTERIOR ELEVATIONS

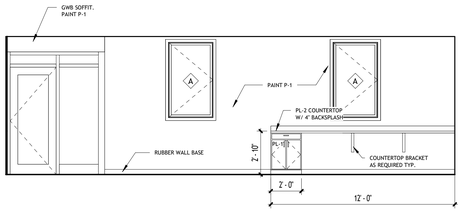
SHEET NO.
A201



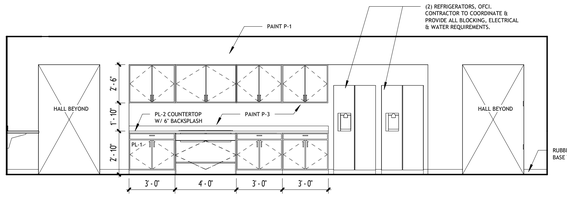
1 OPERATORS - NORTH
1/4" = 1'-0"



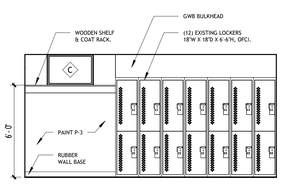
2 OPERATORS - EAST
1/4" = 1'-0"



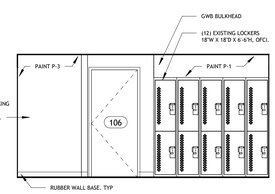
3 OPERATORS - SOUTH
1/4" = 1'-0"



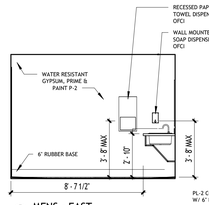
4 OPERATORS - WEST
1/4" = 1'-0"



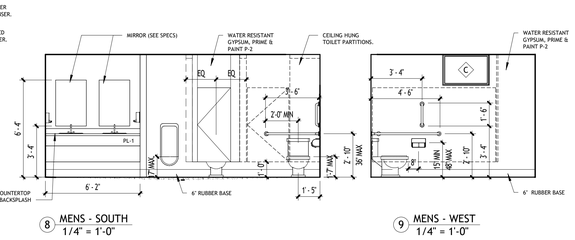
5 HALL NORTH
1/4" = 1'-0"



6 HALL - SOUTH
1/4" = 1'-0"

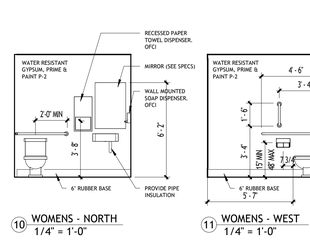


7 MENS - EAST
1/4" = 1'-0"

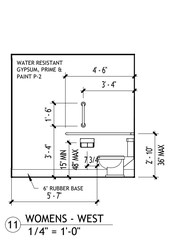


8 MENS - SOUTH
1/4" = 1'-0"

9 MENS - WEST
1/4" = 1'-0"



10 WOMENS - NORTH
1/4" = 1'-0"



11 WOMENS - WEST
1/4" = 1'-0"

RESTROOM NOTES:
1. G.C. TO PROVIDE ADDITIONAL BLOCKING WITHIN NEW OR EXISTING WALLS TO SUPPORT ANY AND ALL ACCESSORIES.
2. SEE SPECIFICATIONS FOR MORE DETAILS ON TOILET ACCESSORIES.
3. G.C. TO COORDINATE FINAL TOILET ACCESSORY SELECTIONS AND PURCAHSE WITH OWNER PRIOR TO METAL STUD FRAMING/BLOCKING PHASE OF WORK.
4. ADDITIONAL WALL MOUNTED ACCESORIES MAY BE PURCHASED BY THE OWNER AND INSTALLED BY THE G.C. UNDER SEPARATE CONTRACT.
5. NO EPOXY PAINT ON EXTERIOR WALLS

MArch
MASTERS
ARCHITECTURE PLLC
22 S. PACK SQ. SUITE 301, ASHEVILLE, NC 28801

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NEW OPERATORS BUILDING FOR CATAWBA COUNTY LANDFILL

4017 ROCKY FORD RD, NEWTON, NC 28658



REVISION

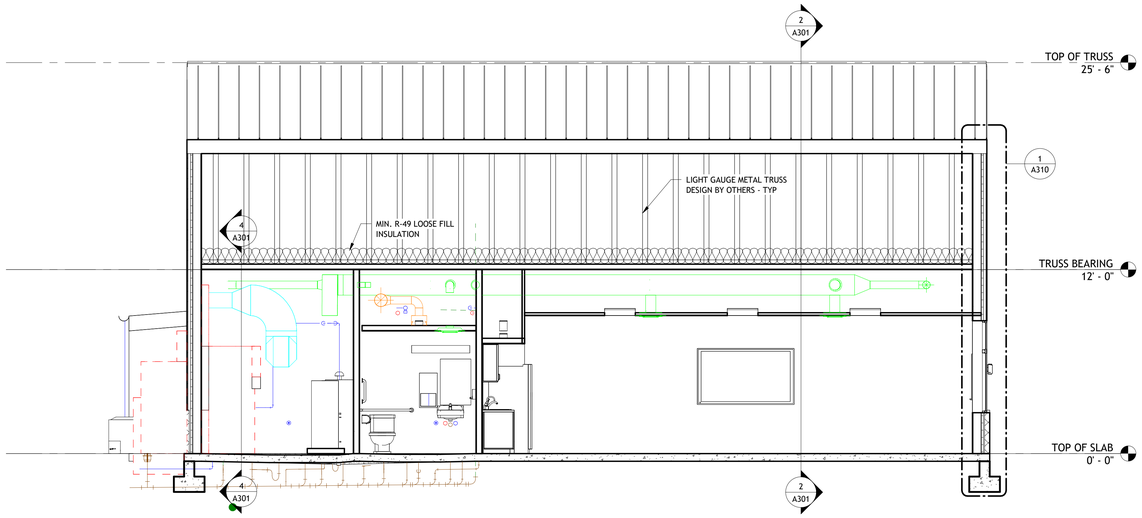
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08/25/26
ISSUE

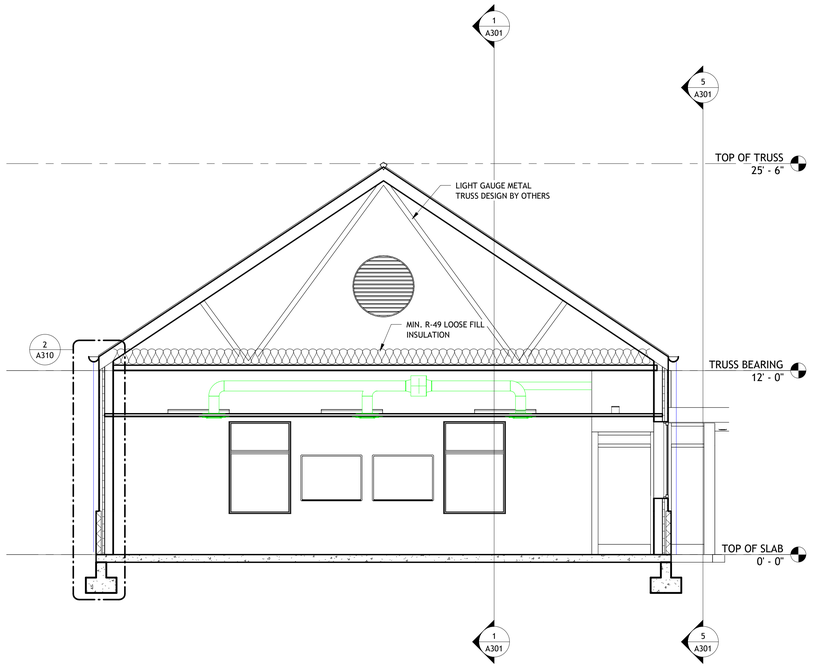
SHEET TITLE
INTERIOR ELEVATIONS

SHEET NO.
A210

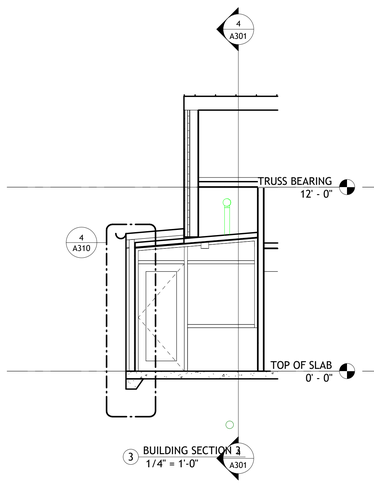
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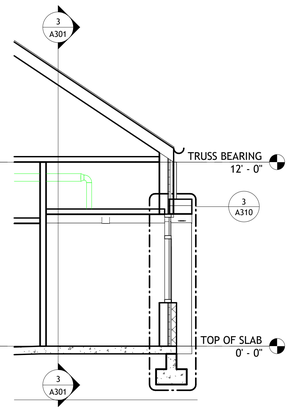
1 BUILDING SECTION 1
1/4" = 1'-0"



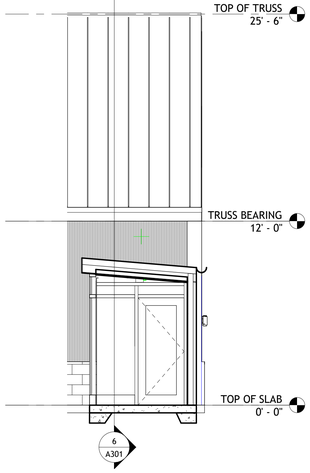
2 BUILDING SECTION 2
1/4" = 1'-0"



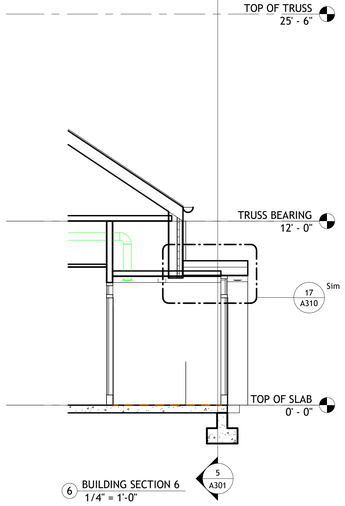
3 BUILDING SECTION 3
1/4" = 1'-0"



4 BUILDING SECTION 4
1/4" = 1'-0"



5 BUILDING SECTION 5
1/4" = 1'-0"



6 BUILDING SECTION 6
1/4" = 1'-0"

MASTERS ARCHITECTURE PLLC
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NEW OPERATORS BUILDING FOR

CATAWBA COUNTY LANDFILL

4017 ROCKY FORD RD, NEWTON, NC 28658

MASTERS ARCHITECTURE, PLLC
REGISTERED ARCHITECTURAL CORPORATION
CERT. NO. 53428
NORTH CAROLINA
ASHEVILLE, NC

MARK ALEXANDER MASTERS
REGISTERED ARCHITECT
7793
NORTH CAROLINA
ASHEVILLE, NC

REVISION

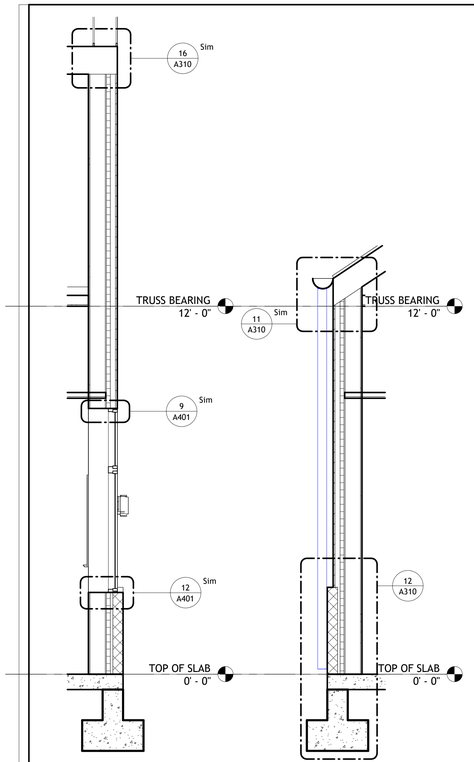
NO.	DESCRIPTION	DATE

DATE
08/25/26
ISSUE

SHEET TITLE
BUILDING SECTIONS

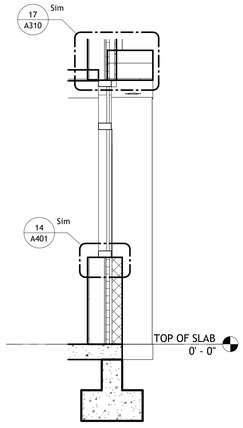
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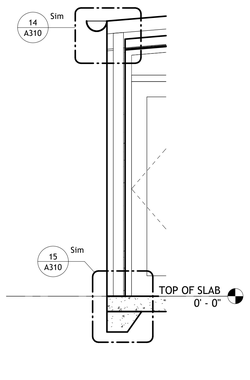


1 WALL SECTION A - 1
1 1/2" = 1'-0"

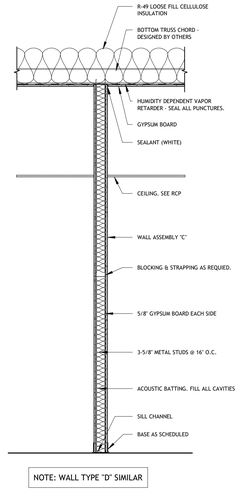
2 WALL SECTION A - 2
1 1/2" = 1'-0"



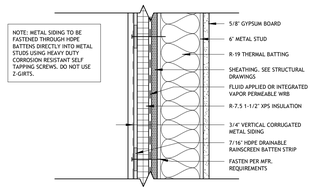
3 WALL SECTION A - 3
1/2" = 1'-0"



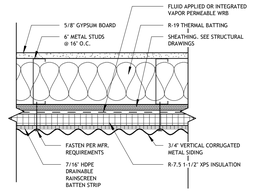
4 WALL SECTION C - 1
1/2" = 1'-0"

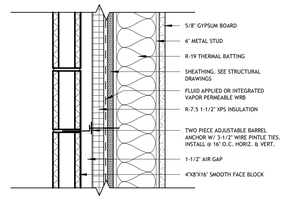


5 WALL SECTION - TYPE "C"
1/2" = 1'-0"

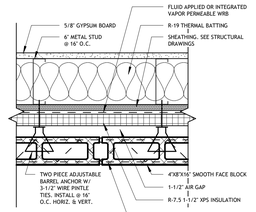


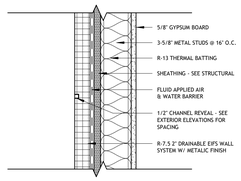
6 WALL ASSEMBLY A.1
1 1/2" = 1'-0"



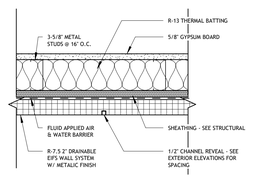


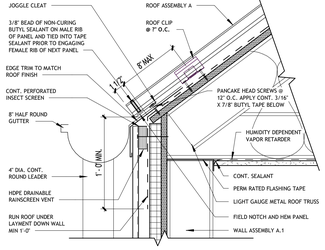
7 WALL ASSEMBLY A.2
1 1/2" = 1'-0"



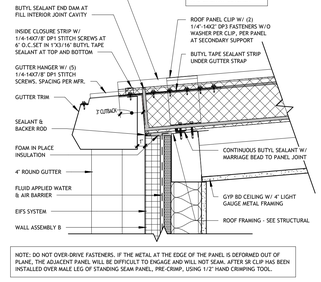


8 WALL ASSEMBLY B
1 1/2" = 1'-0"

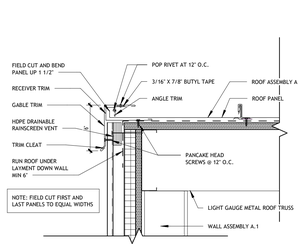




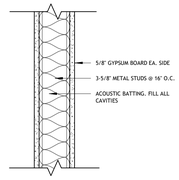
11 ROOF EDGE AT GUTTER
1 1/2" = 1'-0"



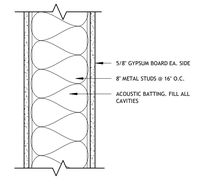
14 I.M.P. ROOF GUTTER
1 1/2" = 1'-0"



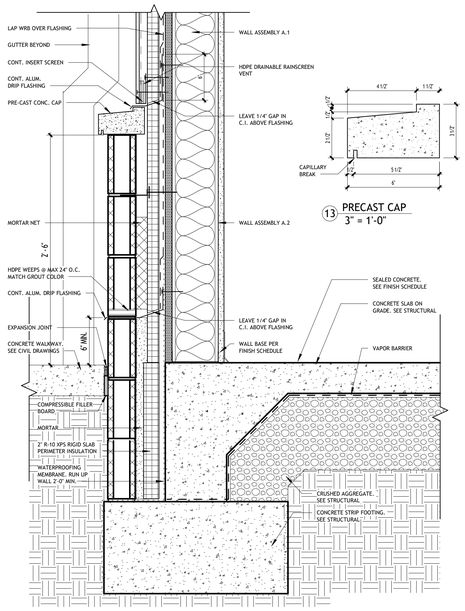
16 ROOF EDGE
1 1/2" = 1'-0"



9 WALL ASSEMBLY C
1 1/2" = 1'-0"

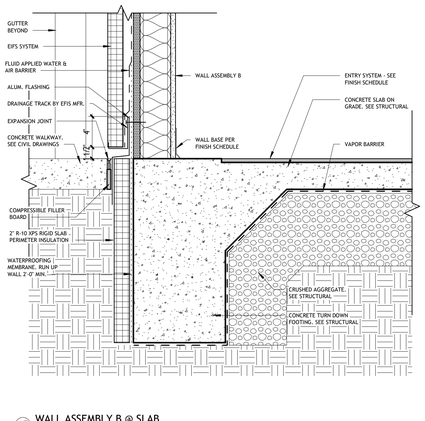


10 WALL ASSEMBLY D
1 1/2" = 1'-0"

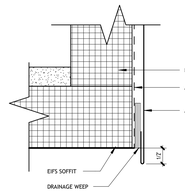


12 WALL ASSEMBLY A @ SLAB
1 1/2" = 1'-0"

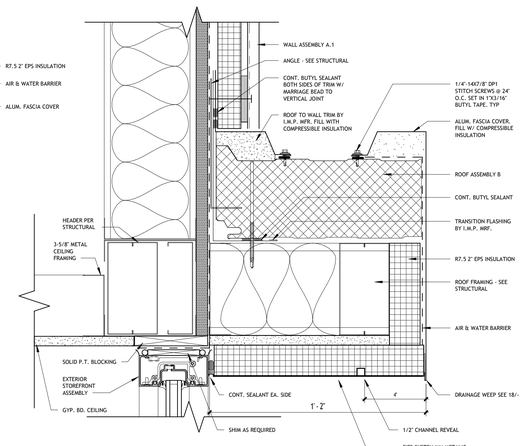
13 PRECAST CAP
3" = 1'-0"



15 WALL ASSEMBLY B @ SLAB
1 1/2" = 1'-0"



18 ROOF FASCIA DRIP EDGE
6" = 1'-0"



17 WALL TO ROOF TRANSITION
3" = 1'-0"

MARCH MASTERS ARCHITECTURE PLLC
22 S. PACK SQ. SUITE 301, ASHEVILLE, NC 28801

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NEW OPERATORS BUILDING FOR CATAWBA COUNTY LANDFILL

4017 ROCKY FORD RD, NEWTON, NC 28658

MASTERS ARCHITECTURE, PLLC
REGISTERED ARCHITECTURAL CORPORATION
CERT. NO. 53428
NORTH CAROLINA
ASHEVILLE, NC

MARK ALEXANDER MASTERS
REGISTERED ARCHITECT
7193
NORTH CAROLINA
ASHEVILLE, NC

REVISION

NO.	DESCRIPTION	DATE

DATE
08/25/26
ISSUE

SHEET TITLE
WALL SECTIONS & DETAILS

SHEET NO.
A310

TEMPLATE VERSION
MODEL: M:\PROJECTS\MACH\Catawba County Operator's Building\11 Construction Documentation\11 | DWG-RVT\Catawba%20Op%20Bldg%071326.rvt

Window Schedule

Type Mark	Size		Type	Material	Finish	Detail			Glazing	Head Height	Comments
	Width	Height				Head	Jamb	Sill	Type		
			Ruskin_ELF815330_Stationary_Lovers								
A	3' - 0"	5' - 0"	CASEMENT, LEFT	ALUM. CLAD WOOD		9/-	11/-	10/-	G1	8' - 8"	
B	4' - 0"	6' - 0"	FIXED - TRANSOM	ALUM. CLAD WOOD		9/-	11/-	12/-	G1	8' - 8"	
C	3' - 0"	2' - 0"	FIXED	ALUM. CLAD WOOD		9/-	11/-	10/-	G1	8' - 0"	

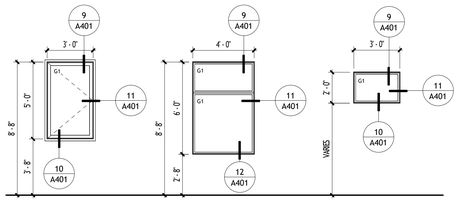
GLAZING SCHEDULE INFORMATION

G1

CLEAR INSULATING GLASS TYPE : LOW-E COATED, INSULATING GLASS.
OVERALL UNIT THICKNESS: [1 INCH (25 MM)]
MINIMUM THICKNESS OF EACH GLASS LITE: ¼" [6 MM]
OUTDOOR LITE: [HEAT-STRENGTHENED] FLOAT GLASS.
INTERSPACE CONTENT: [90% ARGON].
INDOOR LITE: CLEAR HEAT-STRENGTHENED FLOAT GLASS.
LOW-E COATING: SPUTTERED ON SECOND SURFACE AND FOURTH SURFACE.
SPACER: WARM EDGE, COLOR: BLACK.
WINDOW SYSTEM U-FACTOR: 0.27 MAXIMUM.
SUMMER DAYTIME U-FACTOR: 0.24 MAXIMUM.
VISIBLE DAYLIGHT TRANSMITTANCE: 51% MINIMUM
SOLAR HEAT GAIN COEFFICIENT: 0.23 MAXIMUM.
EXTERNAL VISIBLE LIGHT REFLECTANCE: 12%

G2

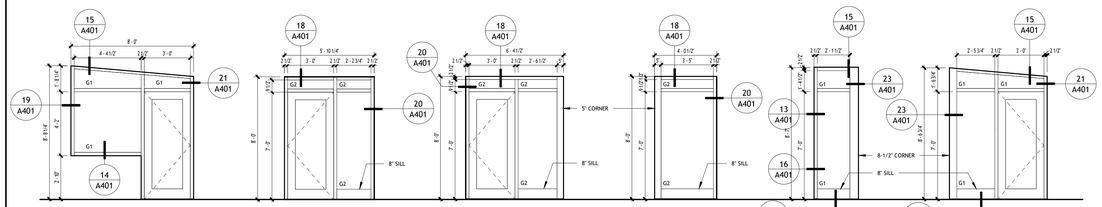
CLEAR, HEAT TREATED GLASS TYPE : FULLY TEMPERED
OVERALL UNIT THICKNESS: 1/4"
MINIMUM THICKNESS OF EACH GLASS LITE: ¼" [6 MM]
INDOOR LITE: CLEAR HEAT-STRENGTHENED FLOAT GLASS.
VISIBLE DAYLIGHT TRANSMITTANCE: 51% MINIMUM



WINDOW A
ALUM. CLAD WOOD

WINDOW B
ALUM. CLAD WOOD

WINDOW C
ALUM. CLAD WOOD



WINDOW E
EXTERIOR STOREFRONT

WINDOW F
INTERIOR STOREFRONT

WINDOW G
INTERIOR STOREFRONT

WINDOW H
INTERIOR STOREFRONT

WINDOW I
EXTERIOR STOREFRONT

WINDOW J
EXTERIOR STOREFRONT

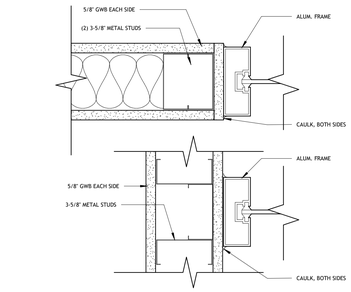
WINDOW ELEVATIONS
1/4" = 1'-0"



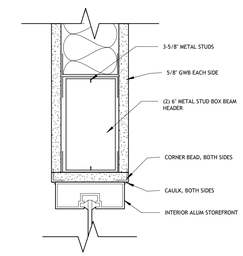
15 ALUM STOREFRONT HEAD
3" = 1'-0"



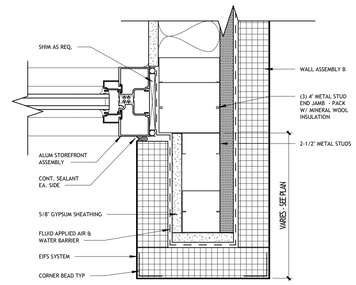
16 STOREFRONT JAMB @ WALL A.2
3" = 1'-0"



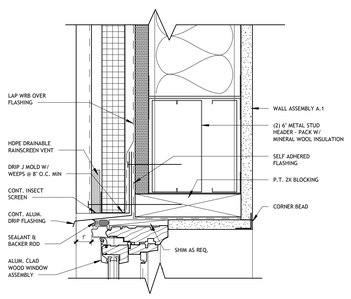
20 INTERIOR ALUM. WINDOW JAMB
3" = 1'-0"



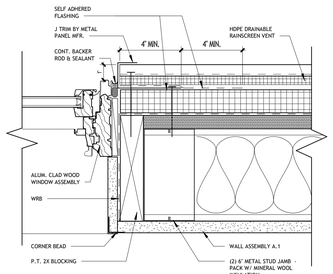
18 INTERIOR ALUM. WINDOW HEAD
3" = 1'-0"



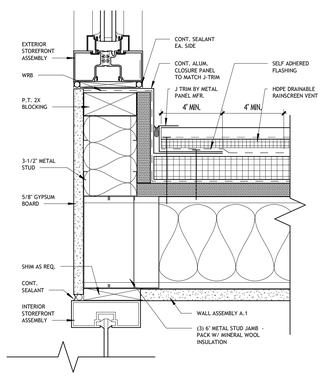
21 STOREFRONT JAMB @ WALL B
3" = 1'-0"



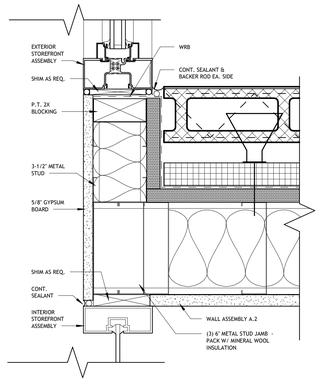
9 WOOD WINDOW HEAD
3" = 1'-0"



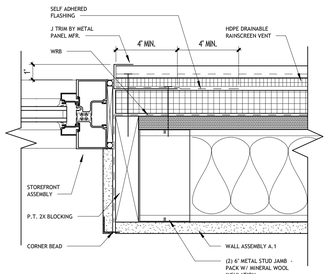
11 WOOD WINDOW JAMB
3" = 1'-0"



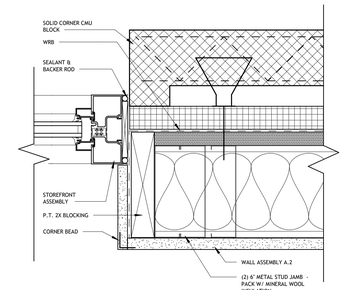
13 STOREFRONT JAMB @ WALL A.1
3" = 1'-0"



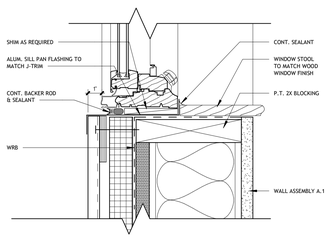
16 STOREFRONT JAMB @ WALL A.2
3" = 1'-0"



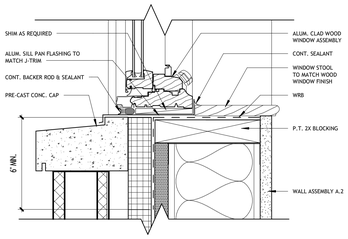
19 STOREFRONT WINDOW JAMB @ WALL A.1
3" = 1'-0"



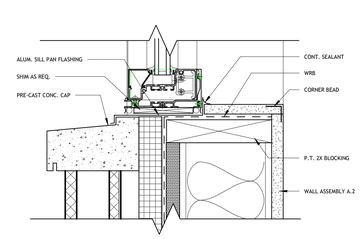
22 STOREFRONT JAMB @ WALL A.2
3" = 1'-0"



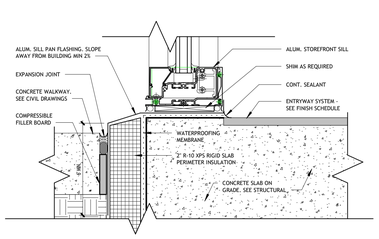
10 WOOD WINDOW SILL
3" = 1'-0"



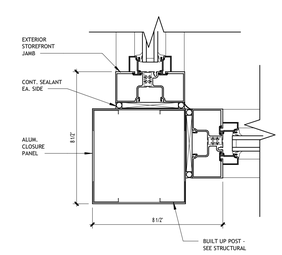
12 WOOD WINDOW SILL @ CMU
3" = 1'-0"



14 ALUM. STOREFRONT SILL @ CMU
3" = 1'-0"



17 ALUM. STOREFRONT SILL @ SLAB
3" = 1'-0"



23 STOREFRONT CORNER JAMB
3" = 1'-0"

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MARK ALEXANDER MASTERS
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7193
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ASHEVILLE, NC

REVISION

NO.	DESCRIPTION	DATE

DATE
08/25/26
ISSUE

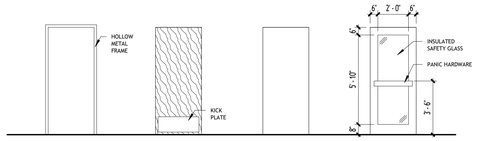
SHEET TITLE
WINDOW SCHEDULES & DETAILS

SHEET NO.
A401

MODEL: M:\PROJECTS\MAC\Catawba County Operator's Building\11 Construction Documentation\11.1 IDWG.RVT\Catawba-CoOpsBldg(071309).rvt
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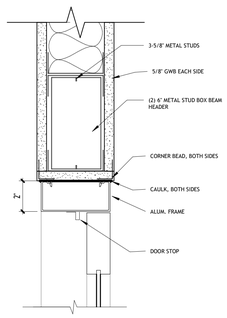
DOOR SCHEDULE

Door Mark	Type	Door Size Width	Size Height	Size Thickness	Door Material	Door Finish	Door Under Cut	Frame Material	Frame Type	Frame Finish	Frame Head	Frame Jamb	Fire Rating Label	Hardware Set No.	Hardware From Room: Number	Comments
101	3	3' - 0"	7' - 0"	0' - 1 3/4"	ALUM			ALUM				10/-		1		
102	3	3' - 0"	7' - 0"	0' - 1 3/4"	ALUM			ALUM				10/-		1		
103	3	3' - 0"	7' - 0"	0' - 1 3/4"	ALUM			ALUM			1/-	2/-		2	108	
104	3	3' - 0"	7' - 0"	0' - 1 3/4"	ALUM			ALUM			1/-	2/-		2	101	
105	2	3' - 6"	7' - 0"	0' - 1 3/4"	HM			HM		HM-1	5/-	6/-		3	104	
106	1	3' - 0"	7' - 0"	0' - 1 3/4"	WOOD			HM		HM-1	3/-	4/-		4	101	
107	1	3' - 0"	7' - 0"	0' - 1 3/4"	WOOD			HM		HM-1	3/-	4/-		6	103	
108	1	3' - 0"	7' - 0"	0' - 1 3/4"	WOOD			HM		HM-1	3/-	4/-		5	102	

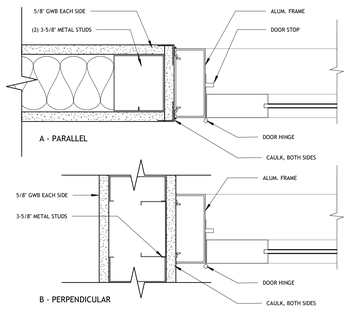


F1 | DOOR 1 WOOD | DOOR 2 HOLLOW METAL | DOOR 3 ALUM

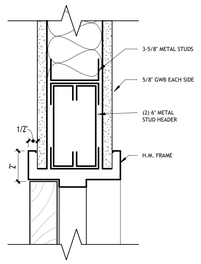
DOOR ELEVATIONS
1/4" = 1'-0"



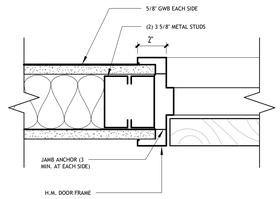
1 INTERIOR ALUM. DOOR HEAD
3" = 1'-0"



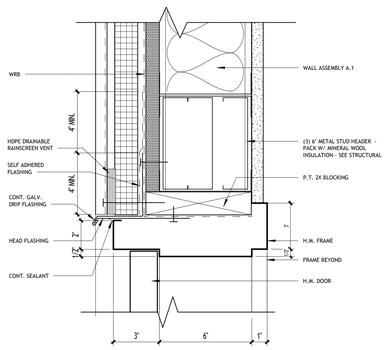
2 INTERIOR ALUM. DOOR JAMB
3" = 1'-0"



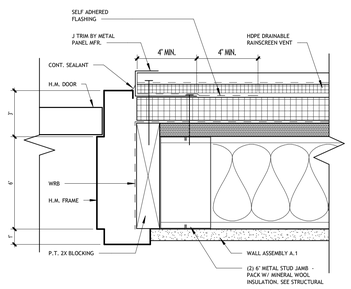
3 H.M. DOOR HEAD
3" = 1'-0"



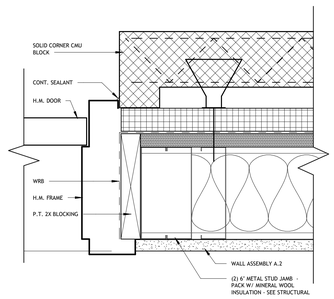
4 H.M. DOOR JAMB
3" = 1'-0"



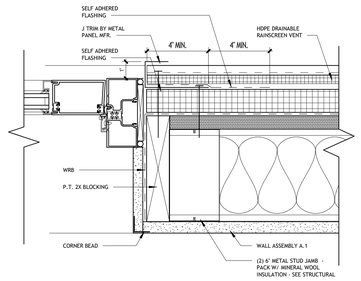
5 EXTERIOR H.M. DOOR HEAD
3" = 1'-0"



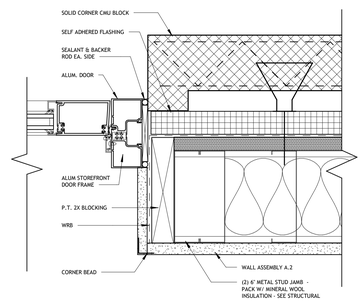
6 H.M. DOOR JAMB @ WALL A.1
3" = 1'-0"



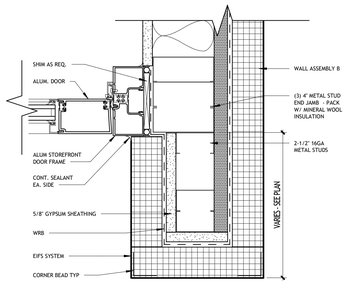
7 H.M. DOOR JAMB @ WALL A.2
3" = 1'-0"



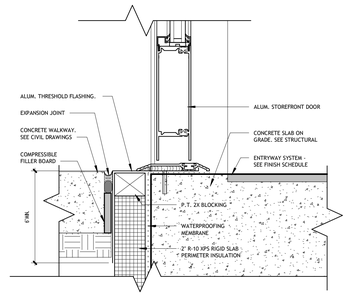
8 ALUM DOOR JAMB @ WALL A.1
3" = 1'-0"



9 ALUM. DOOR JAMB @ WALL A.2
3" = 1'-0"



10 ALUM DOOR JAMB @ WALL B
3" = 1'-0"



11 DOOR THRESHOLD
3" = 1'-0"

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22 S. PACK SQ. SUITE 301, ASHEVILLE, NC 28801

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NEW OPERATORS BUILDING FOR
CATAWBA COUNTY LANDFILL
4017 ROCKY FORD RD, NEWTON, NC 28658



REVISION

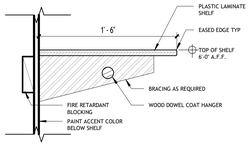
NO.	DESCRIPTION	DATE

DATE
08/25/26
ISSUE

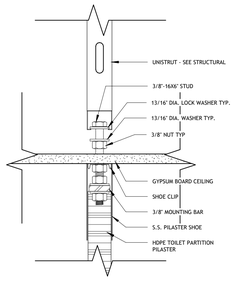
SHEET TITLE
DOOR SCHEDULES & DETAILS

SHEET NO.
A402

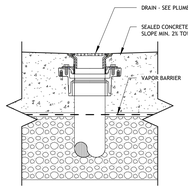
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TEMPLATE VERSION:



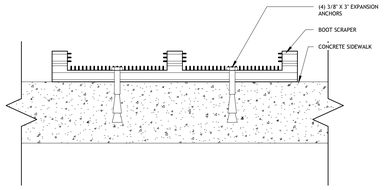
7 COAT RACK & SHELF
1 1/2" = 1'-0"



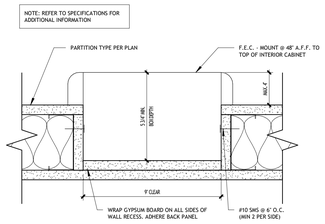
8 CEILING MOUNTED TOILET PARTITION
3" = 1'-0"



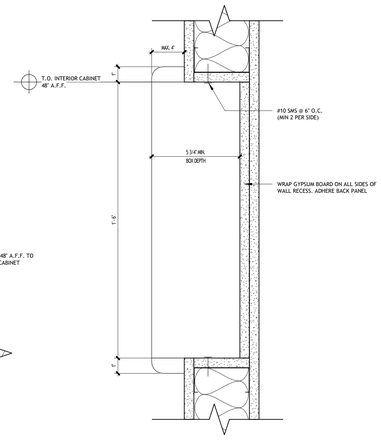
9 FLOOR DRAIN
3" = 1'-0"

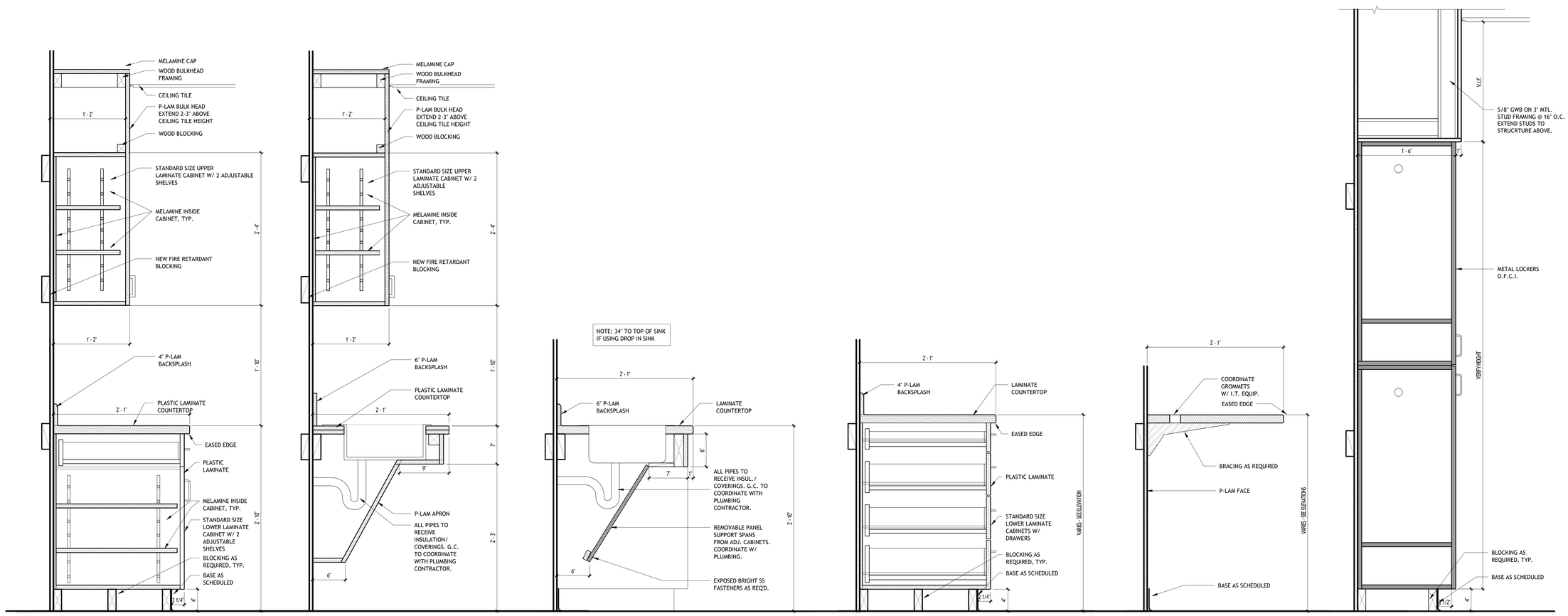


10 BOOT SCRAPER
3" = 1'-0"



11 FIRE EXTINGUISHER CABINET
3" = 1'-0"





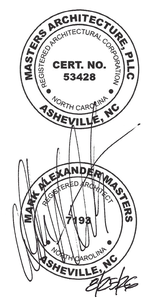
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NEW OPERATORS BUILDING FOR CATAWBA COUNTY LANDFILL

4017 ROCKY FORD RD, NEWTON, NC 28658



REVISION

NO.	DESCRIPTION	DATE

DATE
08/25/26
ISSUE

SHEET TITLE
DETAILS

SHEET NO.
A501

MODEL: M:\PROJECTS\Mod\Catawba County Operator's Building\11 Construction Documentation\11.1 DWG-RVT\Catawba-CoOpsBldg071326.rvt
TEMPLATE VERSION:

PLUMBING LEGEND

PIPING SYMBOLS

	DOMESTIC COLD WATER
	DOMESTIC HOT WATER
SS	SANITARY SOIL
	SANITARY VENT
FCO	FLOOR CLEANOUT
WCO	WALL CLEANOUT
YCO	YARD CLEANOUT
	FLOOR DRAIN
	COMPANION FLANGE
	UNION
	VALVE IN VERTICAL PIPE, NOTED AS TO TYPE
	BALL VALVE
	PRESSURE REDUCING VALVE
	REDUCED PRESSURE BACKFLOW PREVENTOR ASSEMBLY
	BACKFLOW PREVENTER (DOUBLE CHECK)
	VALVE IN VERTICAL PIPE, NOTED AS TO TYPE
HB	HOSE BIBB
FPWH	FREEZE PROOF WALL HYDRANT
X	SHOCK ABSORBER/WATER HAMMER ARRESTER (PDI SIZE X)
	THERMOMETER
	PIPE CAP
	PIPE TURNING DOWN
	PIPE TURNING UP
	TEE WITH BRANCH OFF TOP OF MAIN
	TEE WITH BRANCH OFF BOTTOM OF MAIN

MISCELLANEOUS SYMBOLS AND ABBREVIATIONS

#	DRAWING NOTES
#	REVISION NOTES
AFF	ABOVE FINISH FLOOR
BF	BARRIER FREE
BFF	BELOW FINISH FLOOR
BTUH	BRITISH THERMAL UNIT/HOUR
℄	CENTER LINE
CO	CLEANOUT
D	DRAIN LINE
DCBP	DOUBLE CHECK BACKFLOW PREVENTER
DCW	DOMESTIC COLD WATER
DHW	DOMESTIC HOT WATER
EWH	ELECTRIC WATER HEATER
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FIN	FINISH
FL	FLOOR
FPWH	FREEZE–PROOF WALL HYDRANT
HB	HOSE BIBB
HCP	HANDICAP
INV	INVERT ELEVATION
LAV	LAVATORY
MTV	MASTER TEMPERING VALVE
PRV	PRESSURE REDUCING VALVE
RAC	RUN ABOVE CEILING
RBF	RUN BELOW FLOOR
RBG	RUN BELOW GRADE
RPBP	REDUCED PRESSURE BACKFLOW PREVENTER
SAN	SANITARY
SS	SANITARY SOIL
T&P	TEMPERATURE AND PRESSURE
TMV	THERMOSTATIC MIXING VALVE
TYP	TYPICAL
V	VENT
VLV	VALVE
VTR	VENT THRU ROOF
WC	WATER CLOSET
WCO	WATER CLEANOUT
WHA	WALL HAMMER ARRESTOR
YCO	YARD CLEANOUT
E.C.	ELECTRICAL CONTRACTOR
G.C.	GENERAL CONTRACTOR
M.C.	MECHANICAL CONTRACTOR
P.C.	PLUMBING CONTRACTOR

EQUIPMENT TAG:

X — TYPE & SCHEDULE #

SEISMIC NOTE

FOR BUILDING SEISMIC PERFORMANCE CATEGORY, REFER TO APPENDIX B IN STRUCTURAL DRAWING SET.

TRAP PRIMER NOTE

PROVIDE TRAP PRIMING DEVICES AT EACH FLOOR DRAIN CONNECTED TO SANITARY SEWER (NOT SHOWN), UNLESS NOTED OTHERWISE.

PLUMBING SUMMARY

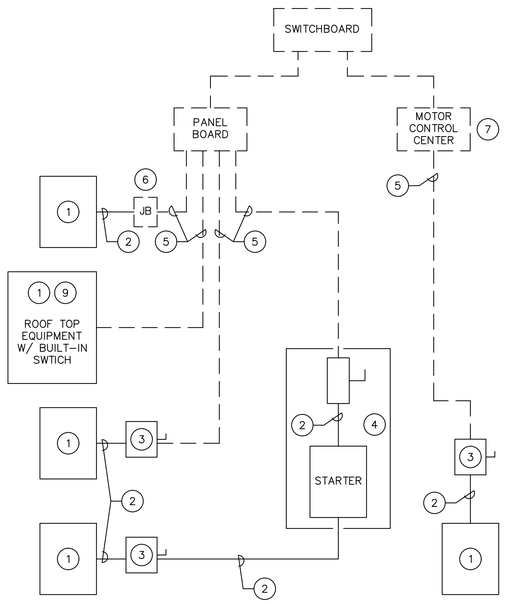
DRAINAGE FIXTURE UNITS: 27

DOMESTIC WATER SUPPLY FIXTURE UNITS: 31.4

DOMESTIC WATER SUPPLY DEMAND: 24 GPM

GENERAL PLUMBING NOTES

1. PLUMBING WORK SHALL BE INSTALLED IN ACCORDANCE WITH THE 2018 EDITION OF THE NORTH CAROLINA STATE PLUMBING CODE.
2. PLUMBING PIPING SHALL BE COORDINATED WITH OTHER TRADES TO AVOID CONFLICTS, INTERFERENCES AND TO PROVIDE A CODE COMPLIANT INSTALLATION.
3. ALL SANITARY SEWER PIPING 4–INCH AND LARGER SHALL BE INSTALLED WITH A SLOPE OF 1/8–INCH PER FOOT UNLESS NOTED OTHERWISE. SANITARY SEWER PIPING LESS THAN 4–INCH SHALL BE INSTALLED WITH A MINIMUM SLOPE OF 1/4–INCH PER FOOT. REFER TO SPECS FOR FURTHER INFORMATION.
4. CLEANOUTS SHALL HAVE TOPS DESIGNED FOR SPECIFIC FLOOR FINISHES SUCH AS CARPET, TILE, ETC., UNLESS NOTED OTHERWISE.
5. ACCESS PANELS SHALL BE PROVIDED AT CONCEALED VALVES, WATER HAMMER ARRESTORS AND OTHER DEVICES.
6. IF EQUIPMENT IS SUBMITTED AND ACCEPTED WITH UTILITY CONNECTIONS OTHER THAN AS SHOWN ON THE DRAWINGS AND SCHEDULES, IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE PROPER UTILITY CONNECTIONS TO THIS EQUIPMENT AT NO ADDITIONAL COST.
7. ALL EQUIPMENT INSTALLED ON FLOOR SHALL BE MOUNTED ON A SITE FABRICATED CONCRETE HOUSEKEEPING PAD. PAD SHALL BE 4" THICK AND EXTEND PAST EQUIPMENT EDGES BY 4" OR LARGER. REINFORCE PAD WITH 6,6,10,10 WIRE MESH AND DOWEL INTO FLOOR SLAB WITH 5/8" REBAR SPACED MAXIMUM OF 2 FOOT ON CENTER. NO PAD SHALL HAVE FEWER THAN 4 DOWELS.
8. THE CONTRACTOR SHALL COORDINATE ANY REQUIRED CUTTING OF WALLS, FLOORS, AND CEILINGS AS REQUIRED FOR INSTALLATION OF PLUMBING WORK WITH GC. ALL CUTTING SHALL BE HELD TO A MINIMUM. PATCH AND FINISH SURFACES TO MATCH ADJOINING SURFACES.
9. REFER TO LARGE SCALE PLANS, RISER DIAGRAMS, AND EQUIPMENT DETAILS FOR VENT PIPING AND VALVING NOT INDICATED ON THE PLANS.
10. DRAWINGS SHALL NOT BE SCALED. REFERENCE ARCHITECTURAL DRAWINGS FOR LOCATIONS OF DOORS, WINDOWS, WALLS, ETC.
11. ALL VERTICAL SUPPLY, WASTE, AND VENT PIPING SHALL BE LOCATED IN WALLS, CHASES OR PARTITIONS, UNLESS NOTED OTHERWISE.
12. SUPPLY PIPING SHALL BE LOCATED ABOVE THE CEILING, UNLESS NOTED OTHERWISE.
13. PROVIDE FOR ACCESS TO ALL EQUIPMENT REQUIRING CLEANING, ADJUSTMENT OR MAINTENANCE.
14. ROUGH–IN LOCATIONS OF CASEWORK UTILITIES SHALL BE COORDINATED WITH CASEWORK PROVIDED.



NOTES:

1. EQUIPMENT OF TRADES OTHER THAN ELECTRICAL
2. CONDUIT AND WIRING BY HVAC, PLUMBING CONTRACTOR OR OTHER TRADES.
3. IF AN ADDITIONAL DISCONNECT IS REQUIRED BY NEC, IT SHALL BE PROVIDED AND INSTALLED BY THE EQUIPMENT CONTRACTOR.
4. A COMBINATION STARTER OR VFD MAY BE USED IN LIEU OF A SEPARATE DISCONNECT SWITCH AND STARTER. LOCATE ADJACENT TO EQUIPMENT.
5. FEEDER CIRCUIT WIRING AND CONDUIT IN ELECTRICAL WORK. SEE PANEL BOARD SCHEDULES FOR WIRE AND BREAKER SIZES.
6. WIRING TROUGH OR JUNCTION BOX (EQUIPMENT ROOMS, EQUIPMENT AREAS, ETC.) MAY BE SHOWN ON ELECTRICAL PLANS FOR SOME EQUIPMENT. IF NO STARTER OR DISCONNECT IS SUPPLIED, A WIRING TROUGH OR JUNCTION BOX SHALL BE INSTALLED ADJACENT TO EQUIPMENT. THE ELECTRICAL CONTRACTOR SHALL PROVIDE LINE SIDE WIRING TO THE WIRING TROUGH OR JUNCTION BOX. LOAD SIDE WIRING WILL BE PROVIDED BY MECHANICAL CONTRACTOR OR OTHER TRADES.
7. PROJECTS UTILIZING AN MCC, THE STARTER CB OR VFD IN THE MCC ARE PROVIDED BY THE ELECTRICAL CONTRACTOR.
8. IN ALL CASES THE EQUIPMENT CONTRACTOR SHALL MAKE FINAL CONNECTIONS, START UP AND TEST EQUIPMENT.
9. IF THE ROOF TOP EQUIPMENT IS NOT PROVIDED WITH BUILT–IN SWITCH, THE ELECTRICAL CONTRACTOR SHALL PROVIDE A DISCONNECT SWITCH.
10. IN A SINGLE PRIME CONTRACT, IT IS THE RESPONSIBILITY OF THE PRIME CONTRACTOR TO COORDINATE BETWEEN THE PLUMBING AND OTHER TRADES.

1 P001 PLUMBING / ELECTRICAL DIVISION OF WORK DETAIL
SCALE: NONE

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NORTH CAROLINA PROFESSIONAL SEAL 040817 ENGINEER DANIEL L GRIFFEE

SIGNED AND DATED:
Daniel Griffee
08/21/26

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ARCHITECT

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NEW OPERATORS BUILDING FOR
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4017 ROCKY FORD RD, NEWTON, NC 28658

KEY PLAN

REVISION

NO.	DESCRIPTION	DATE

DATE
08/21/26

ISSUE
CONSTRUCTION DRAWINGS ISSUE

SHEET TITLE
PLUMBING LEGEND

SHEET NO.
P001

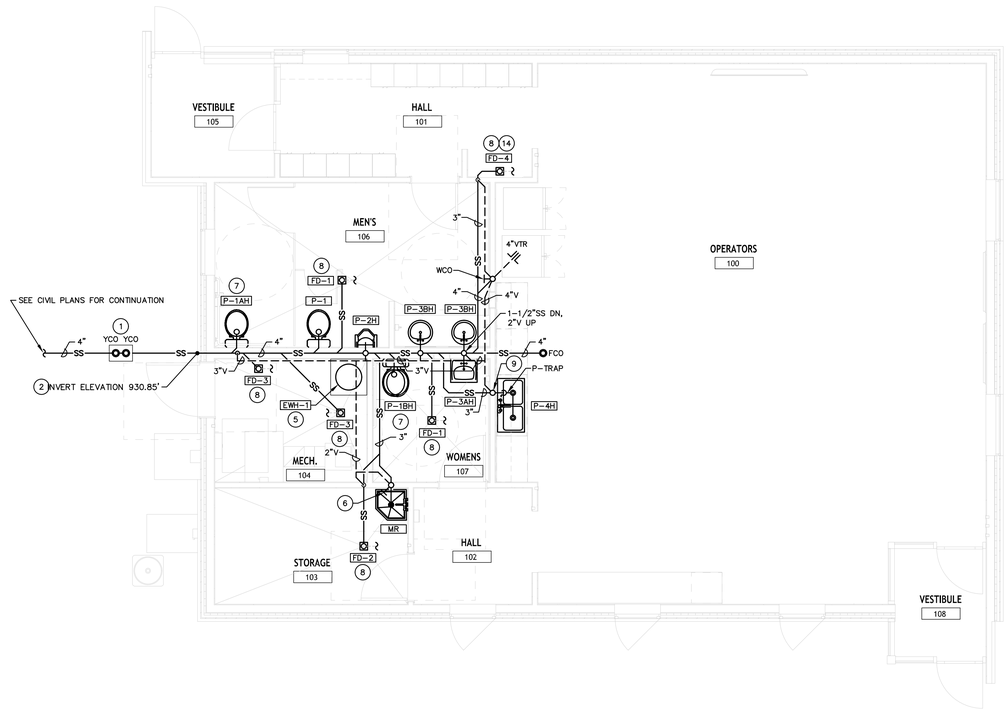
MODEL: P:\2026\26.0070-CATAWBACONC-OPERATORS BUILDING\DRAWINGS\SHEETS\26.0070 - PLUMBING LEGEND.DWG
TEMPLATE VERSION May 29, 2026

GENERAL NOTES:

1. PRIOR TO CONSTRUCTION, COORDINATE ALL UNDERGROUND PIPING AT OR NEAR BUILDING WALL WITH GENERAL CONTRACTOR TO DROP FOOTER ELEVATION AND/OR PROVIDE CODE COMPLIANT PIPING SLEEVE AS REQUIRED.
2. RUN ALL HORIZONTAL SANITARY SOIL PIPING BELOW FLOOR UNLESS NOTED OTHERWISE. RUN ALL SANITARY VENT PIPING ABOVE FINISHED CEILING OR AS HIGH AS POSSIBLE WHERE OPEN TO STRUCTURE ABOVE UNLESS NOTED OTHERWISE.
3. PROVIDE MINIMUM 14AWG TRACER WIRE ATTACHED TO ALL NON-METALLIC PIPING LOCATED UNDER SLAB OR UNDER GRADE. TRACER WIRE SHALL BE AFFIXED TO THE PIPE IN A MANNER TO ALLOW LOCATION OF PIPE FOR MAINTENANCE PURPOSES.
4. RUN ALL DOMESTIC WATER PIPING ABOVE FINISHED CEILING OR AS HIGH AS POSSIBLE WHERE OPEN TO STRUCTURE ABOVE UNLESS NOTED OTHERWISE.
5. SEE CIVIL SPEC FOR UNDERGROUND WATER PIPING MATERIAL. IF MATERIAL IS OTHER THAN COPPER, SHOW TRANSITION TO COPPER 1'-0" AFF. SLEEVE FLOOR SLAB WITH SCHEDULE 40 PVC FOR DOMESTIC WATER ENTRY INTO BUILDING.
6. PRIOR TO STARTUP, CHECK DOMESTIC WATER PRESSURE AT BUILDING ENTRY. IF PRESSURE IS LESS THAN 50 PSI, CONTACT ENGINEER.
7. PRIOR TO CONSTRUCTION, COORDINATE EXACT LOCATION OF ALL FIXTURES AND EQUIPMENT WITH OWNER.
8. INSTALL ALL PLUMBING COMPONENTS PER MANUFACTURER'S INSTRUCTIONS.
9. PROVIDE CLEARANCE IN MECHANICAL ROOM TO ALLOW FOR THE REMOVAL OF ALL PLUMBING EQUIPMENT.
10. INSTALL TYPE 'A' WATER HAMMER ARRESTOR ON ALL INDIVIDUAL DCW AND DHW BRANCHES SERVING WATER CLOSETS, URINAL, LAVATORIES, SINK, AND MOP RECEPTOR.
11. PROVIDE ACCESS TO ALL VALVES AND WATER HAMMER ARRESTERS, INSTALL ACCESS PANEL IF CEILING IS FINISHED. INSTALL NO MORE THAN 12" ABOVE CEILING. COORDINATE SIZE AND EXACT LOCATION OF ALL ACCESS PANELS WITH OWNER.
12. PROVIDE CLEARANCE IN MECHANICAL ROOM TO ALLOW FOR THE REMOVAL OF ALL PLUMBING EQUIPMENT.

DRAWING NOTES:

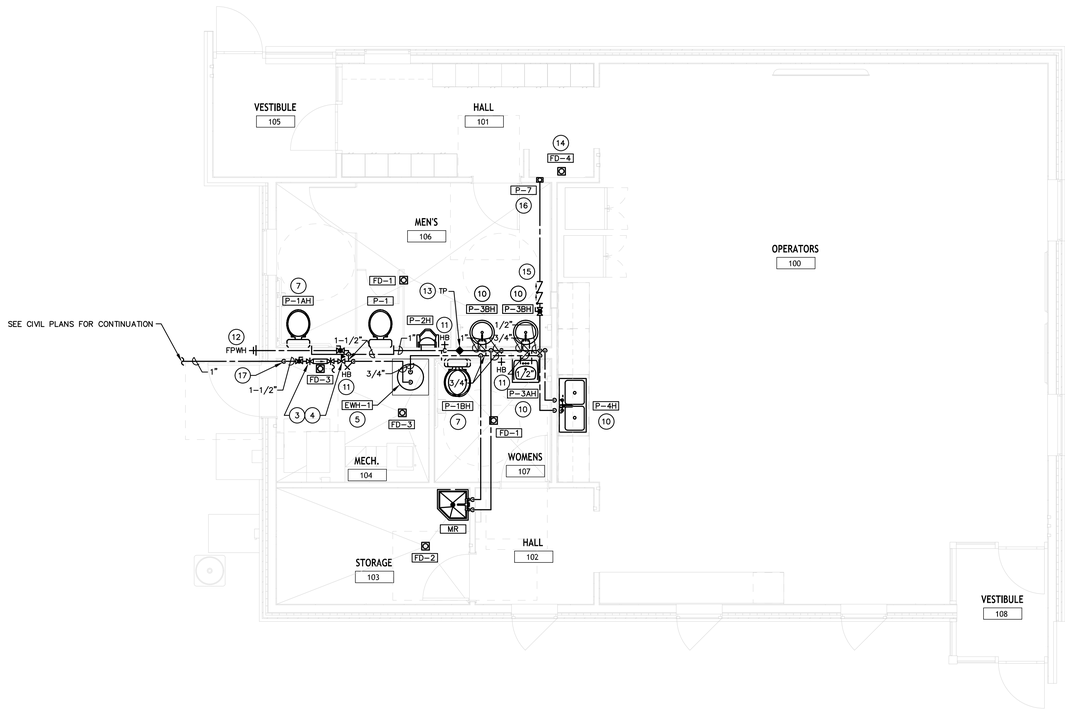
1. PROVIDE SEPARATE YARD CLEANOUT TO SERVE EACH DIRECTION OF BUILDING DRAIN PIPING. THIS SHALL SERVE AS REQUIRED CLEANOUT FOR BOTH BUILDING DRAIN AND BUILDING SEWER AT JUNCTION.
2. INVERT ELEVATION IS BASED ON BUILDING FINISHED FLOOR ELEVATION OF 932.65'.
3. REDUCED PRESSURE BACKFLOW ASSEMBLY AND REDUCING VALVE STATION – SEE DETAIL 2/P501.
4. RUN ALL HORIZONTAL BUILDING ENTRY PIPING WITH BALL VALVE SHUTOFF IN ACCESSIBLE LOCATION APPROXIMATELY 2'-6" ABOVE FINISHED FLOOR. LOCATE AS CLOSE TO WALL AS POSSIBLE WHILE STILL ALLOWING ENOUGH ROOM FOR ALL EQUIPMENT MAINTENANCE.
5. SEE 1/P501 FOR ELECTRIC WATER HEATER EWH-1 CONNECTION DETAIL. INSTALL EQUIPMENT AND PIPING PER MANUFACTURER'S INSTRUCTIONS. PROVIDE FIELD POURED HOUSEKEEPING PAD PER P-001, GENERAL NOTE 7.
6. PROVIDE WALL CLEANOUT IN ACCESSIBLE LOCATION TO ALLOW FOR MAINTENANCE, COORDINATE WITH NEARBY FIXTURES. FOR WALL CLEANOUT NEAR MOP RECEPTOR, LOCATE ABOVE FIXTURE INCLUDING FLANGES.
7. INSTALL WATER CLOSET WITH FLUSH VALVE LEVER ON WIDE SIDE OF TOILET AREA.
8. FLOOR DRAIN SHALL BE CONNECTED TO TRAP PRIMING DEVICE, WHICH MAY SERVE MULTIPLE DRAINS.
9. VERTICAL DRAIN SHALL BE 2", TRANSITION TO 3" PRIOR TO PENETRATING SLAB AND TURNING HORIZONTAL BELOW FLOOR. VENT 2" UP.
10. SET THERMOSTATIC MIXING VALVE SERVING LAVATORY (TMV-1) AND SINK (TMV-2) TO DELIVER MAXIMUM 110°F DOMESTIC HOT WATER, AND INSTRUCT OWNER HOW TO MAINTAIN SETTING.
11. LOCATE HOSE BIBB 2'-0" ABOVE FINISHED FLOOR. ALL BRANCH PIPING IS 3/4".
12. LOCATE FREEZE PROOF WALL HYDRANT 2'-0" ABOVE FINISHED EXTERIOR GRADE OR PAVEMENT. BRANCH PIPING TO FREEZE-PROOF WALL HYDRANT IS 3/4" WITH ACCESSIBLE SHUT-OFF VALVE.
13. 1/2" DCW FROM TRAP PRIMER TO EACH FLOOR DRAIN, AND SHALL BE RATED FOR NUMBER OF FIXTURES SERVING.
14. COORDINATE EXACT LOCATION OF FLOOR DRAIN FD-4 WITH ICE MAKER MACHINE.
15. INSTALL BALL VALVE SHUT-OFF AND DOUBLE CHECK BACKFLOW PREVENTER DCBP-1 ON DCW BRANCH IN ACCESSIBLE LOCATION. SEE PLUMBING FIXTURE SCHEDULE ON SHEET P601 FOR DCBP TYPE.
16. COORDINATE EXACT LOCATION OF ICE MAKER MACHINE DCW SUPPLY BOX P-7 WITH ICE MAKER.
17. BRING 1" BUILDING DCW SUPPLY FROM SITE UP THROUGH MECHANICAL ROOM FLOOR, AND TRANSITION IN VERTICAL TO 1-1/2" AT 1'-0" AFF.



SANITARY SOIL AND VENT PLAN

SCALE: 1/4"=1'-0"

GRAPHIC SCALE 4' 0 2' 4' 8' DIVISION VALUE: 1/4" = 1'-0"



DOMESTIC WATER PLAN

SCALE: 1/4"=1'-0"

GRAPHIC SCALE 4' 0 2' 4' 8' DIVISION VALUE: 1/4" = 1'-0"

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 040817 DANIEL L. GRIFFEE

SIGNED AND DATED: Daniel Griffee

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ARCHITECT

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4017 ROCKY FORD RD, NEWTON, NC 28658

KEY PLAN

REVISION

NO.	DESCRIPTION	DATE

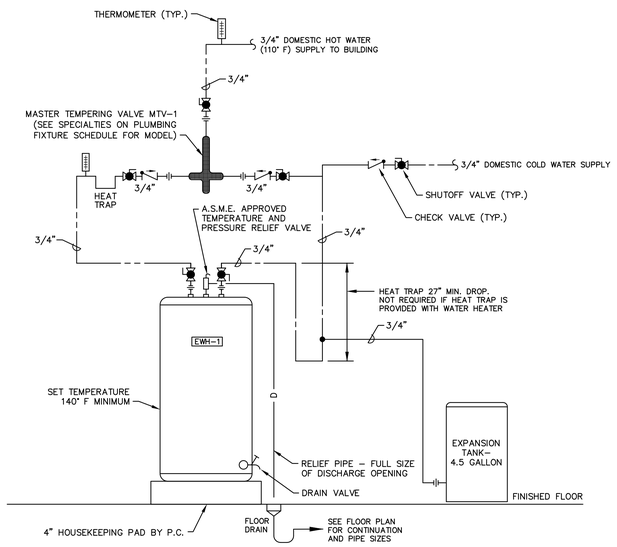
DATE
08/21/26

ISSUE
CONSTRUCTION DRAWINGS ISSUE

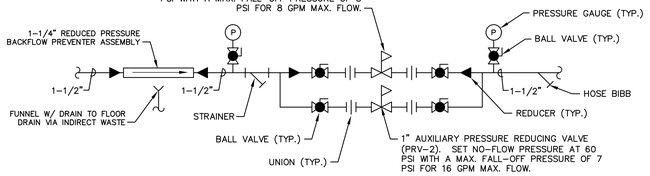
SHEET TITLE
PLUMBING FLOOR PLANS

SHEET NO.
P101

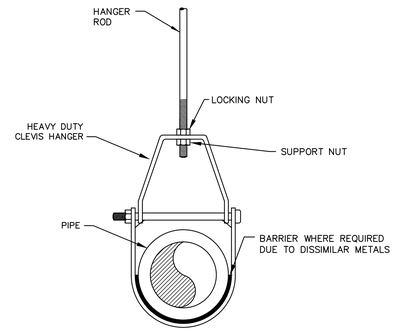
TEMPLATE VERSION May 29, 2026 MODEL: P:\2026\26.0070-CATAWBACONC-OPERATOR'S BUILDING\DRAWINGS\SHEETS\26.0070 1 - PLUMBING FLOOR PLANS.DWG



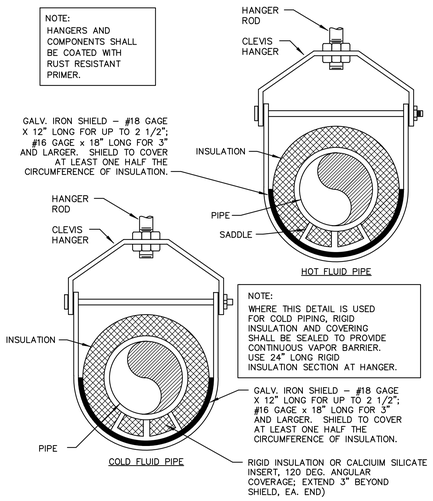
1 P501 ELECTRIC TANK WATER HEATER DETAIL
SCALE: NONE



2 P501 PRESSURE REDUCING VALVE ASSEMBLY DETAIL
SCALE: NONE

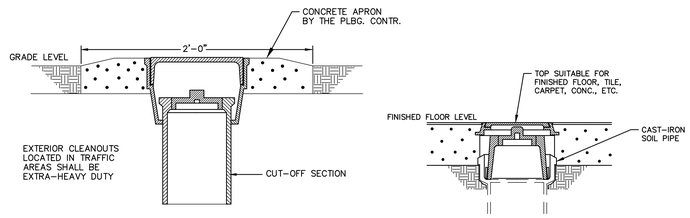


SINGLE HORIZONTAL RUNS
UNINSULATED PIPE

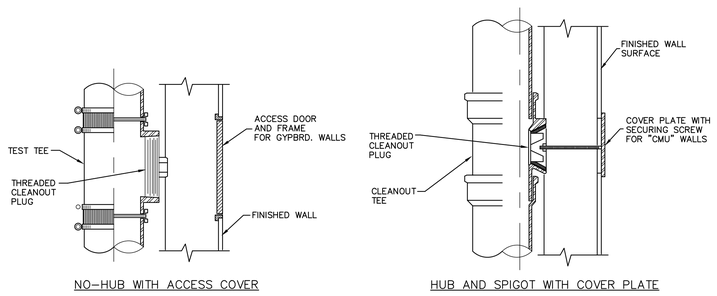


SINGLE HORIZONTAL RUNS
WITH INSULATION

3 P501 CLEVIS HANGER PIPE SUPPORT DETAILS
SCALE: NONE



4 P501 CLEANOUT DETAILS
SCALE: NONE



5 P501 WALL CLEANOUT DETAILS
SCALE: NONE

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NORTH CAROLINA PROFESSIONAL SEAL 040817 ENGINEER DANIEL L GRIFFIS

SIGNED AND DATED:
Daniel Griffis

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PLUMBING DETAILS

SHEET NO.
P501

TEMPLATE VERSION May 29, 2026 MODEL: P:\2026\26.00701-CATAWBACONC-OPERATOR'S BUILDING\DRAWINGS\SHEETS\26.00701 - PLUMBING DETAILS.DWG

PLUMBING FIXTURE - EQUIPMENT CONNECTION SPECIFICATION SCHEDULE

ITEM	DESCRIPTION	WASTE	VENT	CW	HW	SPECIFICATION	MANUFACTURER	MODEL
P-1H	WATER CLOSET	3"	2"	1/2"	–	VITREOUS CHINA, TANK TYPE, STANDARD HEIGHT FLOOR TO RIM, BOTTOM DISCHARGE, HIGH EFFICIENCY, FULLY GLAZED 2-1/8" TRAPWAY, ELONGATED BOWL, SIPHON JET, 1.28 GPF. PROVIDE MCGUIRE LF169LK CLOSET SUPPLY (LOOSE KEY). TANK TRIP LEVER LOCATED ON LEFT SIDE OF TANK. FIXTURE SHALL HAVE 1,000 MaP RATING.	AMERICAN STANDARD	215CA.104
	SEAT					EXTRA HEAVY DUTY, ELONGATED, OPEN FRONT, WITH SELF-SUSTAINING STAINLESS STEEL CHECK HINGE.	BEMIS	9400SSCT
P-1AH	WATER CLOSET [HANDICAPPED]	3"	2"	1/2"	–	VITREOUS CHINA, TANK TYPE, ADA COMPLIANT HEIGHT FLOOR TO RIM, BOTTOM DISCHARGE, HIGH EFFICIENCY, FULLY GLAZED 2-1/8" TRAPWAY, ELONGATED BOWL, SIPHON JET, 1.28 GPF. PROVIDE MCGUIRE LF169LK CLOSET SUPPLY (LOOSE KEY). TANK TRIP LEVER LOCATED ON LEFT SIDE OF TANK. FIXTURE SHALL HAVE 1,000 MaP RATING. INSTALL PER ADA REQUIREMENTS.	AMERICAN STANDARD	215AA.104
	SEAT					EXTRA HEAVY DUTY, ELONGATED, OPEN FRONT, WITH SELF-SUSTAINING STAINLESS STEEL CHECK HINGE.	BEMIS	9400SSCT
P-1BH	WATER CLOSET [HANDICAPPED]	3"	2"	1/2"	–	VITREOUS CHINA, TANK TYPE, ADA COMPLIANT HEIGHT FLOOR TO RIM, BOTTOM DISCHARGE, HIGH EFFICIENCY, FULLY GLAZED 2-1/8" TRAPWAY, ELONGATED BOWL, SIPHON JET, 1.28 GPF. PROVIDE MCGUIRE LF169LK CLOSET SUPPLY (LOOSE KEY). TANK TRIP LEVER LOCATED ON RIGHT SIDE OF TANK. FIXTURE SHALL HAVE 1,000 MaP RATING. INSTALL PER ADA REQUIREMENTS.	AMERICAN STANDARD	215AA.105
	SEAT					EXTRA HEAVY DUTY, ELONGATED, OPEN FRONT, WITH SELF-SUSTAINING STAINLESS STEEL CHECK HINGE.	BEMIS	9400SSCT
P-2H	URINAL [HANDICAPPED]	2"	2"	3/4"	–	VITREOUS CHINA, WALL MOUNTED, ADA COMPLIANT HEIGHT FLOOR TO RIM, ULTRA HIGH EFFICIENCY, WASHDOWN FLUSHING ACTION, 2" NPT OUTLET FLANGE, 3/4" REAR SPUD, 0.125 GPF. INSTALL PER ADA REQUIREMENTS.	SLOAN	SU-1019
	FLUSH VALVE [HANDICAPPED]					BRASS VALVE BODY, CHROME PLATED, EXPOSED DIAPHRAGM VALVE, MANUAL OPERATED LEVER, TOP SPUD CONNECTION, 0.125 GPF. INSTALL PER ADA REQUIREMENTS.	SLOAN	ROYAL 186-0.125-CP
P-3AH	LAVATORY [HANDICAPPED]	1-1/4"	1-1/4"	1/2"	1/2"	VITREOUS CHINA, WALL MOUNTED, 3 HOLE, 4" CENTER-SET, BACKSPLASH, 20-3/4" X 18-1/4" NOMINAL SIZE. PROVIDE MCGUIRE GRID PLUG 155A, SUPPLY KIT H167LK (LOOSE KEY), P-TRAP 8872C. FOR EXPOSED WATER PIPING AND TRAP, PROVIDE TRUBRO LAV GUARD 2 TRAP AND SUPPLY COVER 102 E-Z. INSTALL PER ADA REQUIREMENTS.	SLOAN	SS-3003
	FAUCET [HANDICAPPED]					SOLID BRASS, CHROME PLATED, DECK MOUNTED, 4" CENTERSET, SINGLE CONTROL LEVER, 0.5 GPM. PROVIDE BELOW DECK THERMOSTATIC MIXING VALVE TMV-2 (SEE SPECIALTIES BELOW FOR MODEL). INSTALL PER ADA REQUIREMENTS.	SYMMONS	S202 SERIES
P-3BH	LAVATORY [HANDICAPPED]	1-1/4"	1-1/4"	1/2"	1/2"	VITREOUS CHINA, COUNTER DROP-IN, 3 HOLE, NOMINAL SIZE 17" X 20" AND 8" DEPTH. PROVIDE MCGUIRE GRID PLUG 155A, P-TRAP 8872C, SUPPLY KIT LFH170LK (LOOSE KEY). FOR EXPOSED PIPING, PROVIDE TRUBRO LAV GUARD 2 TRAP AND SUPPLY COVER 102 E-Z. INSTALL PER ADA REQUIREMENTS.	SLOAN	SS-3002
	FAUCET [HANDICAPPED]					SOLID BRASS, CHROME PLATED, DECK MOUNTED, 4" CENTERSET, SINGLE CONTROL LEVER, 0.5 GPM. PROVIDE BELOW DECK THERMOSTATIC MIXING VALVE TMV-2 (SEE SPECIALTIES BELOW FOR MODEL). INSTALL PER ADA REQUIREMENTS.	SYMMONS	S202 SERIES
P-4H	SINK [HANDICAPPED]	1-1/2"	1-1/4"	1/2"	1/2"	TYPE 304, 18 GA STAINLESS STEEL, COUNTER TOP MOUNTED, DOUBLE BOWL, 3 HOLE, 8" CENTERSET, 33" X 19-1/2" AND 6-1/2" DEPTH. PROVIDE MCGUIRE BASKET STRAINER 151AM, P-TRAP 8912C, SUPPLY KIT LFH171LK (LOOSE KEY). PROVIDE TRUBRO LAV GUARD 2 TRAP AND SUPPLY COVER 102 E-Z FOR EXPOSED WATER PIPING/FITTINGS. INSTALL PER ADA REQUIREMENTS.	ELKAY	LRADQ3319653
	FAUCET [HANDICAPPED]					DECK MOUNTED, POLISHED CHROME, 8" CENTERSET, SINGLE LEVER FAUCET, 1.5 GPM. PROVIDE THERMOSTATIC MIXING VALVE TMV-3 BELOW SINK (SEE SPECIALTIES BELOW FOR MODEL). INSTALL PER ADA REQUIREMENTS.	SYMMONS	SK23
P-7	ICE MAKER SERVICE BOX	–	–	1/2"	–	GALVANIZED STEEL BOX WITH WHITE FINISH, 1/4" TURN, HAMMER ARRESTER. PROVIDE OATEY 38686 METAL FACEPLATE.	OATEY	39140
MR	MOP RECEPTOR	3"	1-1/2"	1/2"	1/2"	MOLDED TERAZZO, 24" X 24" X 12", STAINLESS STEEL CAP, (2) TILING FLANGES. PROVIDE OPTIONAL HOSE AND WALL HOOK, MOP HANGER, AND SPLASH PANELS.	STERN WILLIAMS	SBC-1500 SERIES
	FAUCET					SOLID BRASS, CHROME PLATED, WALL MOUNTED, 7-5/8" – 8-3/8" ADJUSTABLE CENTERS, INTEGRAL STOPS, ATMOSPHERIC VACUUM BREAKER SPOUT. PAIL HOOK, WALL BRACE, 3/4" THREAD OUTLET, FULL FLOW.	CHICAGO FAUCETS	897-RCF
FD-1	FLOOR DRAIN [MEDIUM-DUTY]	3"	1-1/2"	–	–	CAST IRON BODY, MEDIUM-DUTY, SATIN FINISH NICKEL, 8" ROUND TOP, ADJUSTABLE COLLAR, 1/2" PRIMER TAP, AND REMOVABLE SEDIMENT BUCKET WITH STAINLESS STEEL MESH BUCKET LINER.	WATTS	FD-100-A SERIES
FD-2	FLOOR DRAIN [HEAVY-DUTY]	3"	1-1/2"	–	–	CAST IRON BODY, HEAVY-DUTY, DUCTILE IRON, 8" ROUND GRATE, ADJUSTABLE COLLAR, 1/2" PRIMER TAP, AND REMOVABLE SEDIMENT BUCKET WITH STAINLESS STEEL MESH BUCKET LINER.	WATTS	FD-320 SERIES
FD-3	FLOOR DRAIN [HEAVY-DUTY]	4"	2"	–	–	CAST IRON BODY, HEAVY-DUTY, DUCTILE IRON, 8" ROUND GRATE, ADJUSTABLE COLLAR, 1/2" PRIMER TAP, AND REMOVABLE SEDIMENT BUCKET WITH STAINLESS STEEL MESH BUCKET LINER.	WATTS	FD-320 SERIES
FD-4	FLOOR DRAIN [MEDIUM-DUTY]	3"	1-1/2"	–	–	CAST IRON BODY, MEDIUM-DUTY, REVERSIBLE CLAMPING COLLAR, ADJUSTABLE NICKEL BRONZE STRAINER WITH 4" DIA. NICKEL BRONZE FUNNEL, 1/2" PRIMER TAP, AND REMOVABLE SEDIMENT BUCKET WITH STAINLESS STEEL MESH BUCKET LINER.	WATTS	FD-100-EF SERIES

NOTES:

1. FIXTURE SELECTION AS INDICATED. SEE SPECIFICATION FOR OTHER ACCEPTABLE MANUFACTURERS.
2. COLOR OF FIXTURE SHALL BE WHITE UNLESS NOTED OTHERWISE.
3. FIXTURES NOT SPECIFIED ARE SPECIFIED BY ARCHITECT.
4. VENTS MAY BE SHOWN LARGER ON PLANS TO ACCOMMODATE DISTANCE OR CONFIGURATION.
5. ALL PLUMBING FIXTURES, EQUIPMENT, VALVES, FITTINGS, AND ACCESSORIES IN DOMESTIC WATER SYSTEM MEANT FOR HUMAN CONSUMPTION ARE REQUIRED TO MEET ALL APPLICABLE LEAD FREE REQUIREMENTS.
6. PROVIDE MOUNTING ACCESSORIES AS REQUIRED, AND FOR THE TYPE OF CONSTRUCTION FIXTURE IS TO BE MOUNTED IN.

SPECIALTIES:

SELECTION BASED ON WATTS. SEE SPECIFICATION FOR OTHER ACCEPTABLE MANUFACTURERS.

CLEANOUTS	FCO WCO YCO	FLOOR – WATTS SERIES CO-260 WALL – WATTS SERIES CO-460-RD (INCLUDES ACCESS COVER AND PLUG) YARD – WATTS SERIES CO-260 IN 18"x18"x4" THICK PAD AS REQUIRED
HOSE BIBBS	HB	WATTS LFSC8-2 (INCLUDES VACUUM BREAKER), 3/4" MALE CONNECTION
FREEZE PROOF WALL HYDRANT	FPWH	WATTS SERIES HY-725 WITH LOCKING BOX AND PERMANENT VACUUM BREAKER. FREEZEPROOF. TYPE DESIGNATION TO MATCH WALL THICKNESS. PROVIDE UNION ELBOW ASSEMBLY TO FIT IN AVAILABLE SPACE FOR WATER CONNECTION.
PRESSURE REDUCING VALVE	PRV-1 PRV-2	WATTS SERIES LF223S 3/4" WATTS SERIES LF223S 1"
REDUCED PRESSURE BACKFLOW PREVENTER	RPBP-1	WATTS SERIES LF009M2-QT-S-FS 1-1/4"
DOUBLE CHECK BACKFLOW PREVENTER	DCBP-1	ICE MAKER: WATTS SERIES LF9D
MASTER TEMPERING VALVE	MTV-1	WATTS 3/4" LFN170-M3 CSUT THERMOSTATIC MIXING VALVE WITH CHECKSTOPS
THERMOSTATIC MIXING VALVE	TMV-1 TMV-2	WATTS LFUSG-CS WATTS SERIES LFMMV
EXPANSION TANK	ET-1	WATTS PLT-12-M1
WATER HAMMER ARRESTORS	WHA	WATTS SERIES LF15M2

ELECTRIC TANK WATER HEATER SCHEDULE

ITEM	LOCATION	STORAGE (GALLONS)	RECOVERY RATE @ 60° F IN GPH	MAX TEMP SETTING	ELECTRICAL				SPECIFICATION	MANUFACTURER	MODEL
					Kw	VOLTS	AMPS	PHASE			
EWH-1	MECHANICAL ROOM	50	30	170°	4.5	240	19	1	ELECTRIC TANK-TYPE, (2) 4,500 WATT NON-SIMULTANEOUS ELEMENTS, TERMINAL BLOCK. PROVIDE ANTI-SCALD THERMOSTATIC MIXING VALVE WITH CHECKSTOPS.	RHEEM	ELD52-TB

NOTES:

1. SEE SPECIFICATION FOR OTHER ACCEPTABLE MANUFACTURERS.

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NORTH CAROLINA PROFESSIONAL SEAL 040817 ENGINEER DANIEL L GRIFFEE

SIGNED AND DATED:
Daniel Griffee

THIS DOCUMENT HAS BEEN DIGITALLY SIGNED AND SEALED IN ACCORDANCE WITH THE STANDARD CERTIFICATION REQUIREMENTS FOUND IN NC ADMINISTRATIVE CODE 21-56.1103(E). THIS DIGITAL SIGNATURE HAS BEEN FOUND BY THE NC BOARD OF EXAMINERS FOR ENGINEERS AND SURVEYORS TO MEET THESE STANDARDS. PLEASE CONTACT THE SIGNER IF YOU NEED ASSISTANCE IN VALIDATING THE SIGNATURE.

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NEW OPERATORS BUILDING FOR

CATAWBA COUNTY LANDFILL

4017 ROCKY FORD RD, NEWTON, NC 28658

KEY PLAN

REVISION

NO.	DESCRIPTION	DATE

DATE
08/21/26

ISSUE
CONSTRUCTION DRAWINGS ISSUE

SHEET TITLE
PLUMBING SCHEDULES

SHEET NO.
P601

TEMPLATE VERSION May 29, 2026 MODEL - P:\2026\26.0701-CATAWBACONC-OPERATORS BUILDING\DRAWINGS\SHEETS\26.0701 - PLUMBING SCHEDULES.DWG

General Plan Symbols

- Plan Revision Number
- Detail Number on Sheet
- Sheet Number Where Detail is Placed
- Keynote Symbol
- Continuation Symbol
- Point Where New Connects To Existing
- Room / 1 — Room Name / Number
- Area Being Demolished
- Area Not In Contract

HVAC Symbols

24"x12"	Sq. Duct Size (Width x Height)
24"/12"	Oval Duct Size (Width / Height)
18"Ø	Round Duct Size (Diameter)
(E)	Existing Duct To Remain
	Duct To Be Demolished
S/A	Supply Air
V/A	Ventilation Air
O/A	Outdoor Air
R/A	Return Air
T/A	Transfer Air
L/A	Building Relief Air
E/A	General Exhaust Air
KED	Kitchen Exhaust Duct
LH	Laboratory Hood
ETS	Env. Tobacco Smoke
FLUE	Flue Gas Vent
C/A	Combustion Air
	Rect. Supply Duct Rise / Drop
	Round Supply Duct Rise / Drop
	Rect. Return Duct Rise / Drop
	Round Return Duct Rise / Drop
	Rect. Exhaust Duct Rise / Drop
	Round Exhaust Duct Rise / Drop

Grille, Register, Diffusers

Terminal Tag — S1 | 55CFM — 24" x 24"
- Type (See Schedule)
- Airflow
- Neck Size / Module Size

Mechanical Equipment

- AHU-3 — New Equipment
- Equipment By Others (Refer To Other Disciplines)

Damper Types

- Manual Damper
- Motorized Damper
- Backdraft Damper
- Smoke Damper
- Fire Damper
- Comb. Fire/ Smoke Damper

Mechanical Piping Symbols

2"	Nominal Pipe Size
	Above Ground Piping
	Below Ground Piping
1/8" / 12" SLOPE	Pipe Slope (When Applicable)
(E)	Existing Pipe To Remain
	Pipe To Be Demolished
CHWR	Chilled-Water Return
CHWS	Chilled-Water Supply
CD	Condensate Drain
CWR	Condenser-Water Return
CWS	Condenser-Water Supply
GWR	Geothermal-Water Return
GWS	Geothermal-Water Supply
HWR	Hot-Water Return
HWS	Hot-Water Supply
G	Natural Gas
LP	Liquid Propane
RL	Refrigerant Liquid
RS	Refrigerant Gas
RD	Refrigerant Discharge
STM	Steam Supply
CDR	Steam Condensate Return
	Pipe Rise / Drop

Valve Types

2" SHUTOFF	Ball Valve
2" BAL	Balancing Valve
2" BFV	Butterfly Valve
2" CHECK	Check Valve
2" CHECK	Alternate Check Valve
3" CIRC	Circuit Setter
2" GATE	Gate Valve
2" GLOBE	Globe Valve
2" LOCK	Locked Shield Valve
2" PRV	Pressure Reducing Valve
2" QUICK	Quick Opening Valve
2" STRAIN	Fluid Strainer
2" M-CNTRL	Elec. Control Valve
4" 3-WAY CNTRL	3-Way Elec. Valve
1" GAS-CNTRL	Emergency Gas Shutoff
1" PLUG	Plug Valve
1" GAS COCK	Gas Shutoff Cock
1" REG	Gas Regulator

Mechanical Devices

AHU-1 — Unit Identity

TS	Temperature Sensor
TH	Temp/ Humidity Sensor
TC	Temp/ CO2 Sensor
T	Thermostat
H	Humidistat
HS	Humidity Sensor
CO2	Carbon Dioxide Detector
CO	Carbon Monoxide Detector
H2	Hydrogen Gas Detector
HZG	Hazardous Gas Detector
NO2	Nitrogen Dioxide Detector
O2	Oxygen Gas Detector

Abbreviations

Ø	ROUND	LVR	LOUVER
ABV	ABOVE	LWT	LEAVING WATER TEMPERATURE
AC	AIR CONDITIONING	M/A	MIXED AIR
AD	AREA DRAIN	MAX	MAXIMUM
ADD	ADDENDUM	MBH	ONE THOUSAND BTU PER HOUR
AFF	ABOVE FINISHED FLOOR	MCF	ONE THOUSAND CUBIC FEET
AFUE	ANNUAL FUEL UTILIZATION EFFICIENCY	MD	MOTORIZED DAMPER
ALT	ALTERNATE	MECH	MECHANICAL
AP	ACCESS PANEL	MFR	MANUFACTURER
ARCH	ARCHITECT/ARCHITECTURAL	MIN	MINIMUM
BFF	BELOW FINISHED FLOOR	MISC	MISCELLANEOUS
BLW	BELOW	MTR	MOTOR
BTU	BRITISH THERMAL UNITS	MU/A	MAKE-UP/AIR
BTUH	BRITISH THERMAL UNITS PER HOUR	NC	NOISE CRITERIA
CAP	CAPACITY	NC	NORMALLY CLOSED
CB	CATCH BASIN	NIC	NOT IN CONTRACT
CFM	CUBIC FEET PER MINUTE	NO	NUMBER
CLG	CEILING	NO	NORMALLY OPEN
CO	CLEAN OUT	NTS	NOT TO SCALE
CW	COLD WATER	O	OXYGEN
D	DEGREE	O/A	OUTSIDE AIR
DB	DRY BULB	ORD	OVERFLOW ROOF DRAIN
DIA	DIAMETER	PD	PRESSURE DROP
DN	DOWN	PIV	POST INDICATOR VALVE
DW	DISTILLED WATER	PLBG	PLUMBING
EA	EACH	PRESS	PRESSURE
EAT	ENTERING AIR TEMPERATURE	PRV	PRESSURE REDUCING VALVE
ELEC	ELECTRICAL	PSI	POUNDS PER SQUARE INCH
EQUIP	EQUIPMENT	PSIG	POUNDS PER SQUARE INCH GAUGE
EWC	ELECTRIC WATER COOLER	PWR	POWER
EWT	ENTERING WATER TEMPERATURE	R	DUCT RISER
E/A	EXHAUST AIR	R/A	RETURN AIR
EXIST	EXISTING	RCP	RADIANT CEILING PANEL
F	DEGREES FAHRENHEIT	RD	ROOF DRAIN
FCO	FLOOR CLEAN OUT	REC	RECESSED
FD	FLOOR DRAIN	RED	REDUCER
FDC	FIRE DEPARTMENT CONNECTION	RH	RELATIVE HUMIDITY
FL	FLOOR	RL/A	RELIEF AIR
FO	FUEL OIL	RM	ROOM
FOV	FUEL OIL VENT	RPM	REVOLUTIONS PER MINUTE
FOR	FUEL OIL RETURN	RW	RAIN WATER
FOS	FUEL OIL SUPPLY	SF	SQUARE FOOT
FPM	FEET PER MINUTE	S/A	SUPPLY AIR
FS	FLOOR SINK	SAN	SANITARY
FT	FOOT/FEET	SF	SQUARE FOOT
FTR	FIN TUBE RADIATION	SD	SMOKE DAMPER
GAL	GALLON	SM	SURFACE MOUNT
GF	GAS-FIRED	SP	STANDPIPE
GC	GENERAL CONTRACTOR	SP	STATIC PRESSURE
GPM	GALLONS PER MINUTE	STM	STEAM
GW	GREASE WASTE	T	THERMOSTAT
HB	HOSE BIB	TD	TEMPERATURE DROP
HP	HORSE POWER	TDR	TRENCH DRAIN
HTG	HEATING	TEMP	TEMPERATURE
HTR	HEATER	TYP	TYPICAL
HW	HOT WATER	UG	UNDERGROUND
HYD	HYDRANT	VAC	VACUUM
ID	INDIRECT	V	VENT
IN	INCH	VAV	VARIABLE AIR VOLUME
INV	INVERT	VENT	VENTILATION
LB	POUND	VTR	VENT THROUGH ROOF
LB/HR	POUNDS PER HOUR	W	WASTE
LAT	LEAVING AIR TEMPERATURE	WB	WET BULB
LP	LOW PRESSURE	WCO	WALL CLEAN OUT
LPG	LIQUEFIED PETROLEUM GAS	WH	WALL HYDRANT

Equipment Abbreviations

AC	AIR CONDITIONING UNIT	ET	EXPANSION TANK
ACCU	AIR COOLING CONDENSING UNIT	EWH	ELECTRIC WATER HEATER
AHU	AIR HANDLING UNIT	FCU	FAN COIL UNIT
AS	AIR SEPARATOR	FP	FIRE PUMP
B	BOILER	GI	GREASE INTERCEPTOR
CH	CHILLER	GRV	GRAVITY ROOF VENTILATOR
CT	COOLING TOWER	HWP	HEATING WATER PUMP
CUH	CABINET UNIT HEATER	HRU	HEAT RECOVERY UNIT
CHWP	CHILLED WATER PUMP	PRV	POWER ROOF VENTILATOR
DBP	DOMESTIC WATER BOOSTER PUMP	RE	RETURN/EXHAUST FAN
DC	DUCT MOUNTED COIL	RTU	ROOFTOP UNIT
DCP	DOMESTIC WATER CIRCULATING PUMP	SP	SUMP PUMP
EF	EXHAUST FAN	UH	UNIT HEATER
EDC	ELECTRIC DUCT COIL	WH	WATER HEATER

* NOTE *
ALL OF GENERAL NOTES ON THIS SHEET ARE TO BE APPLIED TO ALL OTHER DRAWINGS IN THIS SET.THE SYMBOLS AND ABBREVIATIONS SHOWN ON THIS SHEET MAY OR MAY NOT BE USED IN THIS SET OF DRAWINGS.

Project Requirements

A REMOVE ALL UNUSED PIPING, DUCTWORK AND ACCESSORIES.
B WHERE FLOOR DRAINS OCCUR WITHIN THE LIMITS OF CONSTRUCTION, PREVENT CONSTRUCTION DEBRIS FROM ENTERING DRAIN BODY BY SEALING DRAIN OPENING PRIOR TO START OF WORK. UNSEAL DRAINS AT COMPLETION OF CONSTRUCTION.
C COORDINATE INSTALLATION OF PIPING, DUCTWORK, CONDUIT, LIGHTS, CABLE TRAY, STRUCTURE, AND EQUIPMENT TO PREVENT CONFLICTS.
D LOCATE EQUIPMENT REQUIRING ACCESS 2'-0" MAXIMUM ABOVE CEILING.
E LOCATE DUCTWORK, PIPING AND MECHANICAL EQUIPMENT AWAY FROM THE SPACE ABOVE ELECTRICAL PANELS. TRANSFORMERS AND OTHER ELECTRICAL EQUIPMENT.
F PROVIDE SLEEVES AND/OR OPENINGS TO RUN PIPES AND DUCTS THROUGH FOUNDATIONS, FLOORS, WALLS, AND ROOF.
G MAINTAIN CLEAR ACCESS TO SERVICE EQUIPMENT AND OTHER ACCESSORIES REQUIRING SERVICE, VISUAL INSPECTION OR HAND OPERATION. WHERE INDICATED OR REQUIRED, PROVIDE ACCESS PANELS OF THE TYPE SELECTED TO SUIT MATERIALS IN WHICH INSTALLED.
H ADJUST PIPING AND DUCTWORK SIZES TO PROPERLY CONNECT TO MECHANICAL EQUIPMENT.
I INSTALL ALL EQUIPMENT IN ACCORDANCE WITH THE RESPECTIVE MANUFACTURER'S WRITTEN INSTALLATION INSTRUCTIONS, AT A LEVEL OF QUALITY AND WORKMANSHIP CONSISTENT WITH THE SPECIFICATIONS.
J LOCATIONS OF PIPING, DUCTWORK AND EQUIPMENT AS INDICATED ON THE DRAWING, ARE APPROXIMATE AND SUBJECT TO MINOR ADJUSTMENTS IN THE FIELD. WORK SHALL BE COORDINATED WITH ALL OTHER TRADES TO AVOID INTERFERENCE IN THE FIELD.
K INSTALL EXPOSED PIPING AND DUCTWORK AS HIGH AS PRACTICAL IN ROOMS WITHOUT CEILINGS.
L THE CONTRACTOR'S WORK SCHEDULE SHALL BE SUBMITTED TO AND APPROVED BY THE OWNER.
M PRIOR TO STARTING WORK, SUBMIT SHOP DRAWINGS FOR ALL MECHANICAL EQUIPMENT, PLUMBING FIXTURES, AND DIFFUSERS.

HVAC General Notes

1 THE FOLLOWING NOTES ARE GENERAL IN NATURE AND PERTAIN TO THE ENTIRE PROJECT. WHERE THERE ARE EXCEPTIONS, ADDITIONS OR REVISIONS TO THESE NOTES SUCH ARE SO NOTED ON THE PARTICULAR DRAWING WHERE THEY OCCUR. REFER TO SPECIFICATION SECTION 230000 FOR GENERAL REQUIREMENTS OF ALL HVAC WORK.
2 ALL REFERENCES TO SPECIFIC CONTRACTORS AND/OR SUBCONTRACTORS ARE SOLELY FOR THE CONTRACTOR'S CONVENIENCE AS TO THE GENERAL INTENT OF THE DIVISION OF WORK ACCORDING TO OFFICE AND COMMON CONSTRUCTION PRACTICE. IT IS AT THE PRIME CONTRACTOR'S DISCRETION TO APPORTION THE WORK AND BE SOLELY RESPONSIBLE FOR ITS COMPLETE AND ACCURATE EXECUTION.
3 PRIOR TO COMMENCING ANY WORK THE CONTRACTOR SHALL COORDINATE ALL WORK WITH THE WORK OF OTHER TRADES. CONFLICTS ARISING FROM FAILURE TO DO SO SHALL BE RECTIFIED BY THE CONTRACTORS AT NO ADDITIONAL COST.
4 THE DRAWINGS ARE DIAGRAMMATIC AND SHOULD NOT BE SCALED FOR EXACT WORK. IT IS THE INTENT OF THE CONTRACT DOCUMENTS TO ESTABLISH OVERALL SCOPE, MATERIALS AND QUALITY LEVEL FOR COMPLETE AND OPERATIONAL HVAC SYSTEMS. THEREFORE, THE CONTRACTOR SHALL MAKE ADJUSTMENTS AS REQUIRED FOR A COMPLETE INSTALLATION. CONTRACTOR SHALL CLOSELY EXAMINE ALL CONTRACT DOCUMENTS OF ALL TRADES TO UNDERSTAND WORK REQUIRED AND TO AVOID INTERFERENCE WITH EXISTING AND NEW WORK SUCH AS DUCTS, PIPING, LIGHTING FIXTURES, STRUCTURAL BEAMS, ETC.. THESE DRAWINGS ARE BASED ON DOCUMENTS MADE AVAILABLE BY THE CLIENT, THE CONTRACTOR SHALL FIELD VERIFY ALL LAYOUTS AND MAKE NECESSARY ADJUSTMENTS AT NO ADDITIONAL COST.
5 THE HVAC CONTRACTOR SHALL PROVIDE ALL TOOLS, MATERIALS, EQUIPMENT AND NECESSARY FACILITIES, AND PERFORM ALL LABOR AND SERVICES OF EVERY DESCRIPTION AS MAY BE NECESSARY TO COMPLETE THE SCOPE OF WORK DEFINED IN THE DOCUMENTS.
6 PERFORM ALL WORK IN STRICT ACCORDANCE WITH OSHA, ALL APPLICABLE STATE AND LOCAL CODES, AND THE GENERAL AND SUPPLEMENTARY CONDITIONS OF THE CONTRACT. INSTALL ALL EQUIPMENT IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS AND RECOGNIZED INDUSTRY STANDARDS.
7 UNLESS ITEMS OF MATERIAL, EQUIPMENT OR WORK ARE SPECIFICALLY NOTED TO BE PROVIDED OR FURNISHED BY OTHERS, THEY SHALL BE PROVIDED UNDER THIS CONTRACT.
8 PROTECT ALL EQUIPMENT AND MATERIALS FROM DAMAGE THAT ARE STORED OR SET IN PLACE ON THE JOBSITE.
9 INSTALL ALL EQUIPMENT AND DEVICES REQUIRING ACCESS IN A MANNER TO BE READILY ACCESSIBLE. EQUIPMENT SHALL BE INSTALLED SO IT IS ACCESSIBLE FOR MAINTENANCE AND REPLACEMENT WITHOUT REMOVAL OF RELATIVELY FIXED BUILDING ELEMENTS OR OTHER EQUIPMENT. PRIOR TO INSTALLATION OF SUCH ITEMS, THE HVAC CONTRACTOR SHALL VERIFY SERVICE CLEARANCE REQUIREMENTS AND REPORT ANY INADEQUACIES TO THE ARCHITECT/ENGINEER.
10 PRIOR TO BID, THE CONTRACTOR SHALL EXAMINE ALL PROJECT SPECIFICATIONS, DRAWINGS, AND SHALL PERFORM A THOROUGH SITE VISIT TO DEVELOP A COMPLETE UNDERSTANDING OF THE PROJECT SCOPE INCLUDING EXISTING CONDITIONS. FAILURE TO DO SO SHALL NOT RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY TO PERFORM ALL WORK REQUIRED. THE CONTRACTOR SHALL, UPON REVIEW OF THE DOCUMENTS AND PRIOR TO INSTALLATION OF ANY WORK, ADVISE THE ENGINEER OF ANY DISCREPANCIES WHICH WILL AFFECT THE WORK REQUIRED. ANY EQUIPMENT, TRIM, HARDWARE AND/OR DEVICES CUSTOMARILY USED IN THIS TYPE AND CLASS OF WORK NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK (AS DETERMINED BY THE ARCHITECT/ENGINEER) SHALL BE FURNISHED AND INSTALLED BY THE HVAC CONTRACTOR AS PART OF HIS TOTAL WORK WHETHER OR NOT SPECIFICALLY MENTIONED OR SHOWN IN THE DOCUMENTS.
11 WORK INDICATED AS HAVING MINOR DETAILS OBVIOUSLY OMITTED FOR CLARITY SHALL BE INCLUDED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.
12 THE HVAC CONTRACTOR SHALL VERIFY ALL ELECTRICAL CHARACTERISTICS OF HVAC EQUIPMENT WITH THE ELECTRICAL CONTRACTOR PRIOR TO ORDERING.
13 CONTRACTOR SHALL MAINTAIN ON SITE, AN EXTRA SET OF DRAWINGS AND SPECIFICATIONS FOR THE PURPOSE OF RECORDING CHANGES AND VARIATIONS DAILY, AS WELL AS ADDITIONAL INFORMATION SPECIFIED, AS INDICATED IN SPECIFICATION SECTION 230000. RECORD DRAWINGS SHALL IDENTIFY LOCATION OF MAJOR CONTROL LINES, ACCESS DOORS, TAGGED VALVES, SYSTEMS CONCEALED IN WALLS AND CEILINGS. ALL ITEMS TO BE CONCEALED SHALL BE IDENTIFIED WITH FIELD MEASURED LOCATING DIMENSIONS, AND INSPECTED BY OWNER PRIOR TO COMPLETING ENCLOSURE.
14 THE HVAC CONTRACTOR SHALL PROVIDE ALL MECHANICAL IDENTIFICATION
15 THE HVAC CONTRACTOR SHALL PROVIDE ALL MISCELLANEOUS STEEL SHAPES, HANGER RODS, STRAPS, ETC. REQUIRED FOR ALL HVAC SYSTEM INSTALLATIONS. ALL MECHANICAL SUPPORTS SHALL BE IN FULL COMPLIANCE WITH THE SEISMIC PROVISIONS OF THE CODE.
16 REFER TO THE EQUIPMENT DETAILS AND SPECIFICATIONS FOR PIPING ARRANGEMENT, VALVING AND THE ASSOCIATED APPURTENANCES AT EQUIPMENT.
17 ALL PIPING SHALL BE SUPPORTED ADJACENT TO EQUIPMENT TO PREVENT PIPING WEIGHT BEING PLACED ON EQUIPMENT.
18 THE HVAC CONTRACTOR SHALL BE RESPONSIBLE TO LAYOUT, FURNISH AND INSTALL ALL PIPING EXPANSION COMPENSATION FOR PIPING SYSTEM IN ACCORDANCE WITH THE PARAMETERS AND REQUIREMENTS SET FORTH IN THE SPECIFICATIONS BASED ON THE PIPING MATERIALS SELECTED.
19 ALL PIPING INSULATION SHALL RUN CONTINUOUSLY THROUGH FLOORS, WALLS AND PARTITIONS.
20 ALL DUCTWORK SHALL BE CONSTRUCTED AND TESTED IN ACCORDANCE WITH SMACNA STANDARDS. ALL DUCT SIZES SHOWN ARE INSIDE CLEAR DIMENSIONS.
21 CONTRACTOR SHALL LOCATE THERMOSTATS AND TEMPERATURE SENSORS AT 4'-0" AFF, A MINIMUM OF 8" FROM LIGHT SWITCH.
22 REFER TO HVAC DRAWINGS FOR THERMOSTAT AND TEMPERATURE SENSOR LOCATIONS.
23 CONDENSATE DRAINS SHALL BE SUPPLIED FOR ALL COOLING EQUIPMENT. CONTRACTOR SHALL ENSURE PROPER INSTALLATION AND DRAINAGE AS REQUIRED BY FEDERAL, STATE, AND LOCAL CODES.
24 ALL SUPPLY, RETURN, AND EXHAUST DUCTWORK SHALL BE RATED FOR PRESSURE CLASS OF 2" W.G. UNLESS NOTED OTHERWISE.
25 COORDINATE THE EXACT LOCATION OF ALL CEILING DIFFUSERS, REGISTERS, AND GRILLES WITH NEW LIGHTING.
26 PROVIDE DIFFUSERS AND REGISTERS WITH 4-WAY BLOW PATTERN UNLESS OTHERWISE NOTED.
27 ALL EQUIPMENT INSTALLED ON FLOOR OR FINISHED GRADE SHALL BE MOUNTED ON A SITE FABRICATED CONCRETE HOUSEKEEPING PAD. PAD SHALL BE 4" THICK AND EXTEND PAST EQUIPMENT EDGES BY 4" OR LARGER WHERE INDICATED. REINFORCE PAD WITH 6,6,10,10 WIRE MESH AND DOWEL INTO FLOOR SLAB WITH 5/8" REBAR SPACED MAXIMUM OF 2 FOOT ON CENTER. NO PAD SHALL HAVE FEWER THAN 4 DOWELS.
28 THIS CONTRACTOR SHALL BE REQUIRED TO REPLACE FILTERS ON HVAC EQUIPMENT AFTER ALL DUST PRODUCING CONSTRUCTION HAS BEEN COMPLETED AND PRIOR TO THE FINAL PUNCH.
29 INSTALL, SUPPORT, AND BRACE ALL HVAC DUCTWORK AND ACCESSORIES PER "HVAC DUCT CONSTRUCTION STANDARDS" BY SMACNA, ANSI/SMACNA 006-2006 AND "SEISMIC RESTRAINT MANUAL GUIDELINES FOR MECHANICAL SYSTEMS" BY SMACNA, ANSI/SMACNA 001-2008.
30 ALL MECHANIC, PLUMBING, AND ELECTRICAL COMPONENTS SHALL BE ANCHORED OR BRACED TO MEET THE FORCE AND DISPLACEMENT REQUIREMENTS PRESCRIBED IN THE 2019 CBC, SECTION 161A.1.18 THROUGH 161A.1.26 AND ASCE 7-10 CHAPTERS 13, 29, AND 30.
31 PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEMS SHALL BE BRACED TO COMPLY WITH THE FORCES AND DISPLACEMENTS PRESCRIBED IN ASCE 7-10 SECTION 13.3 AS DEFINED IN ASCE 7-10 SECTION 13.6.8, 13.6.7, AND 2019 CBC SECTION 1616A.1.23, 1616A.1.24, 1616A.1.25 AND 1616A.1.26.
32 MAINTAIN MINIMUM SEPARATION BETWEEN OUTSIDE AIR INTAKES OR OTHER OPENINGS INTO THE BUILDING AND OTHER ELEMENTS AS REQUIRED AND AS FOLLOWS:
33 PLUMBING VENTS AND EXHAUST OUTLETS: 10'-0" SEPARATION
34 ENVIRONMENTAL AIR OUTLETS AND DOMESTIC DRYER VENTS: 3'-0" SEPARATION

APPENDIX B

2018 BUILDING CODE SUMMARY
FOR ALL COMMERCIAL PROJECTS

MECHANICAL DESIGN
MECHANICAL SUMMARY

MECHANICAL SYSTEMS, SERVICE SYSTEMS AND EQUIPMENT
- Thermal Zone: 4A
  - winter dry bulb: 19°F
  - summer dry bulb: 90°F
- Interior design conditions
  - winter dry bulb: 72°F
  - summer dry bulb: 75°F
  - relative humidity: 50%
- Building heating load: 74 MBH
- Building cooling load: 34 MBH
- Mechanical Spacing Conditioning System
  - Unitary
    - description of unit: REFER TO EQUIPMENT SCHEDULES
    - heating efficiency: REFER TO EQUIPMENT SCHEDULES
    - cooling efficiency: REFER TO EQUIPMENT SCHEDULES
    - size category of unit: REFER TO EQUIPMENT SCHEDULES
  - Boiler
    - Size category. If oversized, state reason.: N/A
  - Chiller
    - Size category. If oversized, state reason.: N/A
- List equipment efficiencies: REFER TO EQUIPMENT SCHEDULES

HVAC SHEET INDEX

M101 Mechanical Plan
M201 Mechanical Details
M001 HVAC Title Sheet

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NORTH CAROLINA PROFESSIONAL SEAL 040817 ENGINEER DANIEL L. GRIFFEE

SIGNED AND DATED:
Daniel Griffee

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CONTROL DESCRIPTIONS

1. AIR HANDLING UNIT SHALL PROVIDE EXHAUST FAN CONTROL AND EXHAUST FANS SHALL OPERATION SHALL BE CONTINUOUS WHILE THE BUILDING IS IN OCCUPIED MODE.
2. AIR HANDLING UNIT SHALL BE CONTROLLED BY A 7 DAY PROGRAMMABLE THERMOSTAT. MOTOR OPERATED OA CONTROL DAMPER SHALL OPEN WHEN THE BUILDING IS SCHEDULED TO BE OCCUPIED AND CLOSE WHEN UNOCCUPIED. AHU SHALL BE CONTROLLED BY MANUFACTURER'S SINGLE ZONE VAV CONTROLS AND VENTILATION CONTROLS AS DESCRIBED IN SCHEDULE.

LOUVER SCHEDULE

L#-	LOCATION	DIMENSIONS (IN.)			PERFORMANCE			MANUFACTURER/MODEL NO.	NOTES
		WIDTH	HIGHT	DEPTH	(CFM)...	(IN W.G.)...	WATER...		
L-1	OPERATOR BUILDING O/A	24	12	6	255	0.02	0.01	RUSKIN /EME545D	ALL

NOTES
1 ALTERNATIVE MANUFACTURES :CONSTRUCTION SPECIALTIES ,ARROW DOWCO ,PRICE ,NAILOR
2 PROVIDE ALL LOUVERS WITH "1/4GALVANIZED OR ALUMINUM BIRD SCREEN.
3 SUPPLY CUSTOM COLOR SELECTION BY OWNER.
4 VERIFY ROUGH OPENING SIZE PRIOR TO ORDERING LOUVERS.
5 LOUVER SHALL INCLUDE POWER OPEN, SPRING CLOSED 120V / 1 PHASE / 60 HZ MOTOR.

EXHAUST FAN SCHEDULE

EF#	LOCATION	CFM (MAX.)	E.S.P.	RPM	ELECTRICAL		SOUND LEVEL SONES	MAX BHP	MANUFACTURER/MODEL	NOTES
					HP	VOLTS/ø				
EF-1	GENERAL EXHAUST	250	1	1,714	1/4	120/1	11.5	0.17	GREENHECK/SQ-98-VG	1-3

NOTES:
1) ACCEPTABLE MANUFACTURS: COOK, AEROVENT.
2) PROVIDE PREMIUM EFFICIENCY MOTOR, VARI-GREEN CONTROLLER, AND START/DISCONNECT WITH LOCKOUT DEVICE. REFER TO ELECTICAL SHEETS FOR MOTOR STARTER REQUIRMENTS AND DIAGRAMS.
3) PROVIDE GRAVITY BACKDRAFT DAMPER.
4) PROVIDE MANUFACTURERS ROOF JACK AND ASSOCIATED COMPONENTS FOR EXHAUST OUTLET ON ROOF.

AIR HANDLING UNIT

AHU #	SERVICES	SUPPLY FAN		COOLING COIL PERFORMANCE					HEAT PUMP PERFORMANCE					ELECTRIC HEATING COIL PERFORMANCE			COOLING ENERGY EFFICIENCY		ELECTRICAL DATA			MANUFACTURER /MODEL #	NOTES:
		CFM	ESP	Gross Cooling Capacity	EAT DB	EAT WB	LAT DB	LAT WB	HSPF2	HEATING CPACITY @ 47°	HEATING CPACITY @ 17°	EAT	LAT	ENERGY USE RATE	LAT	LAT Rise	EER2	SEER2	VOLT/Hz/PHASE	MCA	MOCP		
		cfm	in H2O	MBh	F	F	F	F	BTUH/KW	MBh	MBh	F	F	KW	F	F				A	A		
AHU1-	OPERATOR BUILDING	1390	1	42	77	64	55	53	8.8	45	35	95	81	10	87	25	10.5	17.5	1 / 60/ 208	6.5	15	DAIKIN /DFVE42CP1300	ALL

NOTES:
1 ACCEPTABLE MANUFACTURERS :TRANE ,CARRIER ,LENNOX
2 PROVIDE THE FOLLOWING EQUIPMENT ACCESSORIES :FILTER FRAME KIT ,CONDENSER COIL GUARDS ,FAN DELAY RELAY ,PREMIUM EFFICIENCY SUPPLY FAN MOTOR WITH VFD ,MERV 8FILTERS ,SERVICE VALVES ,HINGED SERVICE ACCESS ,THERMAL EXPANSION DEVICE ,STAINLESS STEEL DRAIN PANS.
3 PROVIDE FACTORY-MOUNTED DDC UNIT CONTROLLER
4 PROVIDE SINGLE-ZONE VAV CONTROLS ,COMPLETE WITH SUPPLY FAN VFD ,DISCHARGE AIR TEMPERATURE SENSOR AND ZONE TEMPERATURE SENSOR
5 WITHOUT THE NEED FOR AN OUTDOOR AIR MEASURING STATION ,THE UNIT SHALL MANAGE THE FAN SPEED ACCORDING TO THE OUTDOOR AIR DAMPER POSITION TO PREVENT OVER VENTILATING.

AIR DISTRIBUTION DEVICE SCHEDULE

MARK	SERVICE	FRAME SIZE (IN.)	NOMINAL NECK SIZE (IN)	MOUNTING / TYPE	DISCHARGE PATTERN (FACE TYPE)	NOISE (NC) CRITERIA	MAX P.D. (IN)	MANUFACTURER/MODEL NO.	NOTES
S1	SUPPLY	24 X 24	6	LAY-IN CEILING MOUNT	DIRECTIONAL	<25	0.05	TITUS/ TMS 8Ø-24X24	ALL
S1	SUPPLY	24 X 24	8	LAY-IN CEILING MOUNT	DIRECTIONAL	<25	0.05	TITUS/ TMS 6Ø-24X24	ALL
S2	SUPPLY	6X6	6	FLUSH IN CEILING OR DUCT	PREFORATED FACE	<25	0.05	TITUS/ 350 RL 6X6	ALL
R1	RETURN	24 X 24	8	LAY-IN CEILING MOUNT	EGGCRATE	<25	0.05	TITUS/ 50F 18X18	ALL
R2	RETURN	6X6	6	DUCT	PREFORATED FACE	<25	0.05	TITUS/ 350 RL 6X6	ALL
R3	RETURN	10X3	6	DUCT	PREFORATED FACE	<25	0.05	TITUS/ S301FS 10X3	ALL

NOTES:
1) PROVIDE NECESSARY NECK TRANSITIONS FOR DUCTED DIFFUSERS AT SIZES SHOWN ON DRAWINGS.
2) CONTRACTOR SHALL CONFIRM CEILING TYPES, MOUNTING DETAILS AND ACCESSORIES REQUIRED AND FINISH REQUIRED BY THE ARCHITECT PRIOR TO ORDERING. APPROVAL OF ARCHITECT IS REQUIRED.
3) PROVIDE ALUMINUM CONSTRUCTION UNLESS NOTED OTHERWISE.
4) ADD FINISH REQUIRED BY THE ARCHITECT PRIOR TO ORDERING. APPROVAL OF ARCHITECT IS REQUIRED.

OUTSIDE CONDENSING UNIT SCHEDULE

CU#	SYSTEM	NOMINAL TONS	TOTAL COOLING CAPACITY [MBH]	EER2	COOLING OAT DB °[F]	ELECTRICAL			MANUFACTURER/MODEL NO.	NOTES
						MCA	MOCP [AMP]	V /Ø		
CU1-	AHU1-	3.5	35	10.5	95	31.8	35	1/ 208	DAIKIN /DH7VSA3610	ALL

NOTES:
1 PROVIDE ANTI SHORT CYCLE TIMER ,SUB-COOLER ,LOW AMBIENT KIT ,VIBRATION ISOLATION.
2 PROVIDE REFRIGERANT PIPE SIZE AND ACCESSORIES AS REQUIRED BY MANUFACTURER FOR ACTUAL LENGTH OF LINE SET.
3 PROVIDE WITH SINGLE POINT POWER AND SERVICE DISCONNECT.

VENTILATION SUMMARY

AHU#-	OCCUPANCY TYPE	#PEOPLE	CFM/PERSON	AREA OA FLOWRATE	AREA	VENTILATION EFFECTIVENESS	AREA RATE OA REQUIRED [CFM]	PEOPLE RATE OA REQUIRED [CFM]	BREATHING ZONE CFM	OUTDOOR AIR REQUIRED	REQUIRED EXHAUST	EXHAUST PROVIDED
AHU1-	OFFICE	12	5	0.06	1821	0.8	109	60	169	212	212	250

MODEL: C:\Users\ecooper\OneDrive - McGill Engineering\Documents\26.00701 - Operators Bldg - MEP V26_Central Model_ed.cooperQKN65.rvt
TEMPLATE VERSION:

MArch
MASTERS ARCHITECTURE PLLC
22 S. PACK SQ, SUITE 301, ASHEVILLE, NC 28801

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NEW OPERATORS BUILDING FOR CATAWBA COUNTY LANDFILL

4017 ROCKY FORD RD, NEWTON, NC 28658

KEY PLAN

REVISION

NO.	DESCRIPTION	DATE
	Title Sheet Revision	

DATE
08/21/26

ISSUE
CONSTRUCTION DRAWINGS ISSUE

SHEET TITLE
HVAC Title Sheet

SHEET NO.
M001

GENERAL NOTES:

1. MAINTAIN MINIMUM 10'-0" BETWEEN OUTSIDE AIR INTAKE LOUVERS AND EXHAUST AIR LOUVERS AND OTHER DEVICES, AND PLUMBING VENTS.

2. M.C. SHALL INSTALL NEW MECHANICAL EQUIPMENT AND REFRIGERANT LINES PER MANUFACTURERS INSTRUCTIONS.

3. ALL DUCT TO BE RUN AS HIGH AS POSSIBLE ABOVE THE CEILING AND AGAINST THE BOTTOM OF STRUCTURE, COORDINATE WITH FREE AREAS BETWEEN STRUCTURE AND OTHER TRADES.

KEYNOTES:

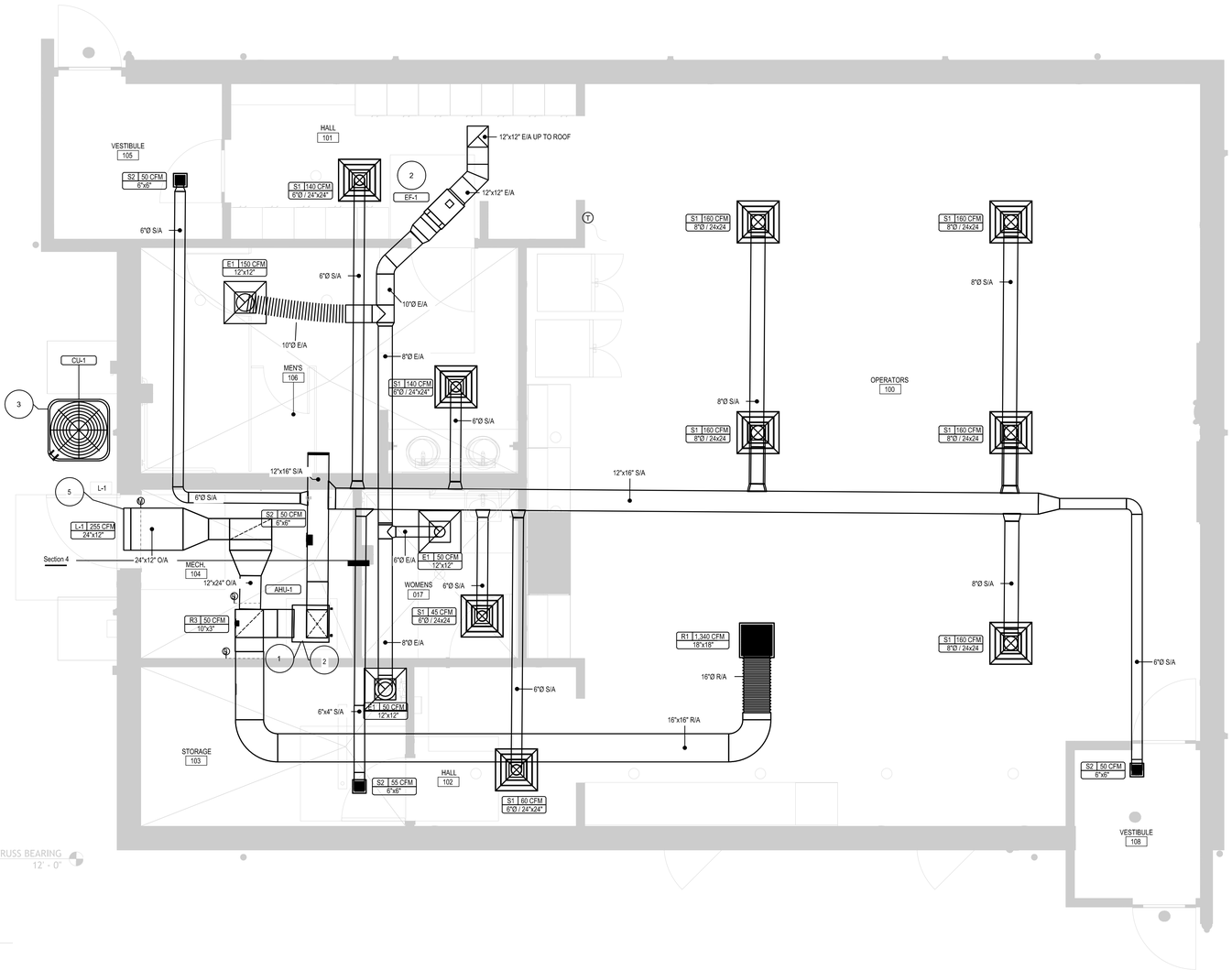
1. ROUTE CONDENSATE TO FLOOR DRAIN.

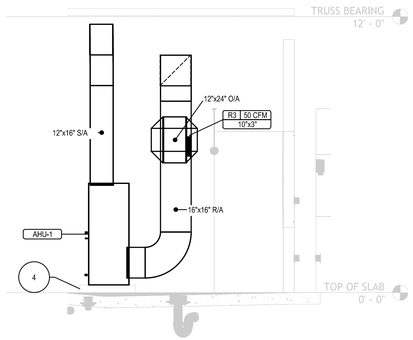
2. COORDINATE LOCATION OF AHU-1 TO MAINTAIN SERVICE ACCESS AND CLEARANCE, INCLUDING ABILITY TO REMOVE AND REPLACE FILTERS.

3. BATHROOM EXHAUST FAN WITH 12"x12" DUCT TO WALL OUTLET. SEE EQUIPMENT SCHEDULE FOR EXHAUST FAN.

4. MECHANICAL EQUIPMENT SHALL BE INSTALLED ON 4" CONCRETE PAD. SEE NOTE 27 ON SHEET M001.

5. ROUTE OUTSIDE AIR INTAKE TO SIDEWALL LOUVER. PLACE 18" BELOW ROOF OVERHANG.





1 / M101 Section 4
3/8" = 1'-0"

0 2' 4' 6'

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SEAL 040817 REGISTERED PROFESSIONAL ENGINEER

SIGNED AND DATED:

Daniel Griffeth

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NO.	DESCRIPTION	DATE

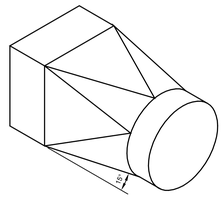
DATE
08/21/26

ISSUE
CONSTRUCTION DRAWINGS ISSUE

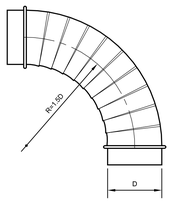
SHEET TITLE
Mechanical Plan

SHEET NO.
M101

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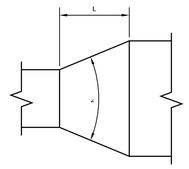


M 1 RECTANGULAR TO ROUND TRANSITION
NOT TO SCALE



NOTE:
USE UP TO 2" WG AND 14" DIA.

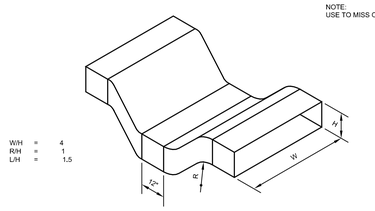
M 2 PLEATED ELBOW (ROUND ONLY)
NOT TO SCALE



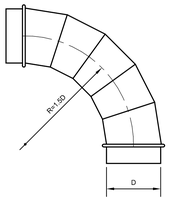
∠ MAX, 45° DIVERGING, 60° CONVERGING

M 3 CONCENTRIC TRANSITION
NOT TO SCALE

NOTE:
USE TO MISS OBSTRUCTION.

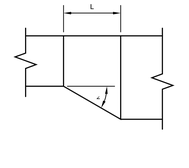


M 5 RECTANGULAR DUCT W/ (4) 45° ELLS
NOT TO SCALE



NOTE:
USE ABOVE 8" DIA. AND ABOVE 2" WG.

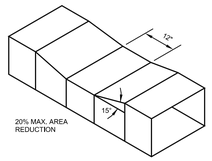
M 6 GORED ELBOW (ROUND OR FLAT OVAL)
NOT TO SCALE



∠ MAX, 30° (EXCEPT 45° IS PERMITTED AT ROUND TO FLAT OVAL)

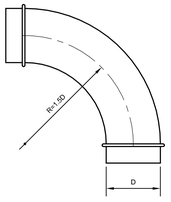
M 7 ECCENTRIC TRANSITION
NOT TO SCALE

NOTE:
USE TO MISS OBSTRUCTION.



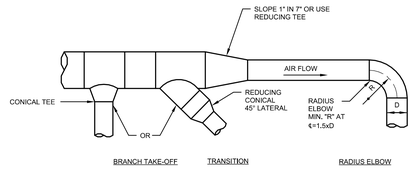
NOTE:
GENERALLY THESE FITTINGS SHALL BE AVOIDED IF POSSIBLE. CONTRACTOR SHALL REVIEW WITH ENGINEER PRIOR TO FABRICATION IF FIELD CONDITIONS REQUIRE THIS OPTION AS A LAST RESORT.

M 9 RECTANGULAR DUCT DEPRESSION
NOT TO SCALE



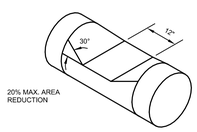
NOTE:
USE UP TO 8" AND ABOVE 2" WG

M 10 DIE-STAMP ELBOW (ROUND ONLY)
NOT TO SCALE



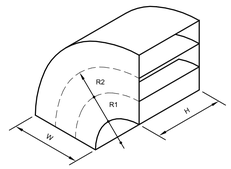
M 11 MEDIUM OR HIGH PRESSURE DUCTWORK
NOT TO SCALE

NOTE:
USE TO MISS OBSTRUCTION.



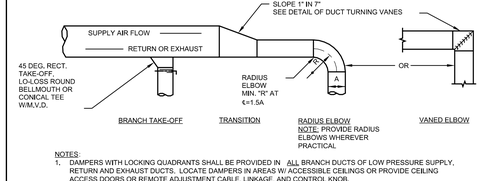
NOTE:
GENERALLY THESE FITTINGS SHALL BE AVOIDED IF POSSIBLE. CONTRACTOR SHALL REVIEW WITH ENGINEER PRIOR TO FABRICATION IF FIELD CONDITIONS REQUIRE THIS OPTION AS A LAST RESORT.

M 12 ROUND DUCT DEPRESSION
NOT TO SCALE



NOTE:
SEE PG. 14.21 SMACNA "HVAC SYSTEMS DUCT DESIGN" 1990 EDITION FOR SPACING AND RADIUS.

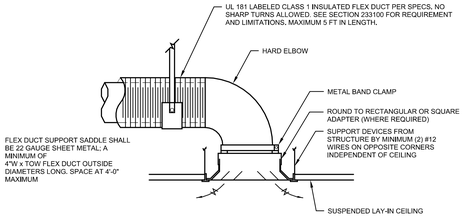
M 13 SMOOTH RADIUS ELBOW W/ SPLITTER VANES
NOT TO SCALE



NOTE: PROVIDE RADIUS ELBOWS WHEREVER PRACTICAL

NOTES:
1. DAMPERS WITH LOCKING QUADRANTS SHALL BE PROVIDED IN ALL BRANCH DUCTS OF LOW PRESSURE SUPPLY, RETURN AND EXHAUST DUCTS. LOCATE DAMPERS IN AREAS W/ ACCESSIBLE CEILINGS OR PROVIDE CEILING ACCESS DOORS OR REMOTE ADJUSTMENT CABLE, LINKAGE, AND CONTROL KNOB.
2. INSULATE BRANCH DUCTS AS SPECIFIED.
3. DAMPERS ARE NOT REQ'D. WHERE A TERMINAL UNIT SUPPLIES ONE AIR DIFFUSER.
4. SEE SPECIFICATIONS FOR SEISMIC RESTRAINT REQUIREMENTS.

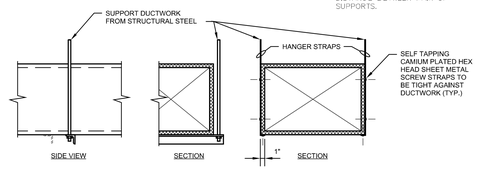
M 14 LOW PRESSURE SUPPLY, RETURN OR EXHAUST MAIN/BRANCH DUCT DETAILS
NOT TO SCALE



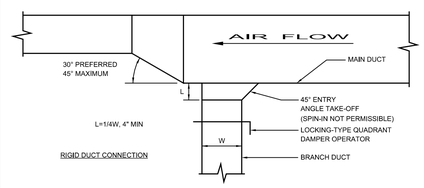
M 4 DIFFUSER DETAIL
NOT TO SCALE

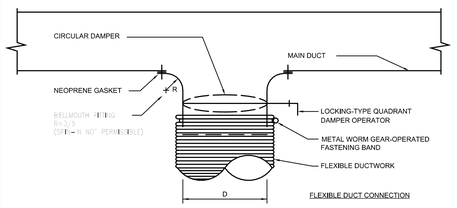
HANGER SIZES FOR RECTANGULAR DUCTWORK			
MAX. SIDE	HANGER	HORIZONTAL SUPPORT ANGLE	MAXIMUM SPACING
30"	1" 18 GUAGE STRAP	NONE REQUIRED	10'-0"
36"	1/4"ø ROD	1 1/2"X1 1/2"X1/8"	8'-0"
48"	1/4"ø ROD	2"X2"X1/8"	8'-0"
60"	5/16"ø ROD	2"X2"X1/8"	8'-0"
84"	3/8"ø ROD	2"X2"X1/8"	8'-0"

NOTES:
1.) FASTEN HANGERS TO STRUCTURAL STEEL WITH BEAM CLAMPS OR JOIST CLAMPS.
2.) FASTEN HANGERS TO CONCRETE SLABS WITH EXPANSION BOLTS AS RATED BY EXPANSION BOLT MANUFACTURER.
3.) SUPPLY AIR DUCTS SHALL BE INSULATED AS PER SPECIFICATIONS.
4.) POP RIVETS WILL NOT BE PERMITTED.
5.) MAXIMUM SPACING INDICATES DISTANCE BETWEEN PAIR OF SUPPORTS.

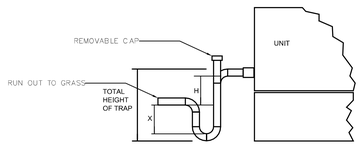


M 8 DUCT STRAP/HANGER DETAIL
NOT TO SCALE





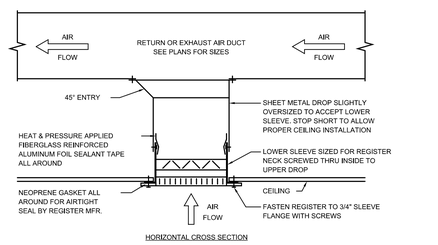
M 16 LOW PRESSURE BRANCH TAKEOFF DETAILS
NOT TO SCALE



CONSTRUCT TRAP AND DRAIN OF SCHEDULE 40 PVC WITH UNGLUED JOINTS
TOTAL HEIGHT OF TRAP = X+H+(1-1/2 x PIPE DIAMETER)
(WITHOUT INSULATION)

BLOW THROUGH	DRAW THROUGH
X = MIN. 1" PLUS CASING STATIC PRESSURE	X = 1/2 "H"
H = MIN. 1"	H = MIN. 1" PLUS CASING STATIC PRESSURE

M 17 AHU CONDENSATE DRAIN
NOT TO SCALE



HORIZONTAL CROSS SECTION

REGISTER SHALL HAVE HORIZONTAL FACE BARS SET AT 35°. WHERE THE REGISTER IS LOW IN THE WALL, TURN THE FACE BARS DOWN; WHERE THE REGISTER IS HIGH IN THE WALL, TURN THE FACE BARS UP. IF THE REGISTER IS LOCATED IN THE CEILING, TURN THE REGISTER SO THE LEAST VISION CAN BE SEEN INTO THE DUCT.

M 18 RETURN/EXHAUST REGISTER DETAIL
NOT TO SCALE

1 M201 Details 1
12" = 1'-0"
0 2' 4' 6'

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SEAL 040837 REGISTERED ARCHITECT

SIGNED AND DATED:
Daniel Griffee

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NEW OPERATORS BUILDING FOR CATAWBA COUNTY LANDFILL

4017 ROCKY FORD RD, NEWTON, NC 28658

KEY PLAN

REVISION

NO.	DESCRIPTION	DATE

DATE
08/21/26

ISSUE
CONSTRUCTION DRAWINGS ISSUE

SHEET TITLE
Mechanical Details

SHEET NO.
M201

MODEL: P:\Revit\Jobs\26.00701 - Operators Bldg - MEP-V26_Central Model_detail.rvt
TEMPLATE VERSION:

Electrical Abbreviations

1P	1 Pole (2P, 3P, 4P, ETC.)
A, Amp	Ampere
AC	Above Counter
ACLG	Above Ceiling
ADO	Automatic Door Opener
AF	Amp Frame
AFF	Above Finished Floor
AFG	Above Finished Grade
AFI	Arc Fault Circuit Interrupter
AHU	Air Handling Unit
AL	Aluminum
ALT	Alternate
AMP	Ampere
AMPL	Amplifier
ANNUN	Annunciator
APPROX	Approximately
AQ-STAT	Aquastat
ARCH	Architect, Architectural
AS	Amp Switch
AT	Amp Trip
ATS	Automatic Transfer Switch
AUTO	Automatic
AUX	Auxiliary
AV	Audio Visual
AWG	American Wire Gauge
BATT	Battery
BD	Board
BLDG	Building
BMS	Building Management System
C	Conduit
CAB	Cabinet
CAT	Catalog
CATV	Cable Television
CB	Circuit Breaker
CCTV	Closed Circuit Television
CKT	Circuit
CLG	Ceiling
COMB	Combination
CMPR	Compressor
CONN	Connection
CONST	Construction
CONT	Continuation Or Continuous
CONTR	Contractor
CONV	Convector
CP	Circulating Pump
CRT	Cathode-Ray Tube
CT	Current Transformer
CTR	Center
CU	Copper
DCP	Domestic Water Circulating Pump
DEPT	Department
DET	Detail
DIA	Diameter
DISC	Disconnect
DIST	Distribution
DN	Down
DPR	Damper
DS	Safety Disconnect Switch
DT	Double Throw
DWG	Drawing
EC	Electrical Contractor
ELEC	Electric, Electrical
ELEV	Elevator
ELU	Emergency Lighting Unit
EM	Emergency
EMS	Energy Management System
EMT	Electrical Metallic Tubing
EP	Electric Pneumatic
EQUIP	Equipment
EWC	Electric Water Cooler
EXIST	Existing
EXH	Exhaust
EXP	Explosion Proof
FA	Fire Alarm
FABP	Fire Alarm Booster Power Supply Panel
FACP	Fire Alarm Control Panel
FCU	Fan Coil Unit
FIXT	Fixture
FLR	Floor
FLUOR	Fluorescent
FU	Fuse
FUDS	Fused Safety Disconnect Switch
GA	Gauge
GAL	Gallon
GALV	Galvanized
GC	General Contractor
GEN	Generator
GFI	Ground Fault Circuit Interrupter
GFP	Ground Fault Protector
GND	Ground
GRS	Galvanized Rigid Steel (Conduit)
GYP BD	Gypsum Board
HOA	Hands-Off-Automatic Switch
HORIZ	Horizontal
HP	Horsepower
HPF	High Power Factor
HT	Height
HTG	Heating
HTR	Heater
HV	High Voltage
HVAC	Heating, Ventilating And Air Conditioning
IC	Interrupting Capacity
IG	Isolated Ground
IMC	Intermediate Metal Conduit
INCAND	Incandescent
IR	Infrared
I/W	Interlock With
J-BOX	Junction Box
KV	Kilovolt
KVA	Kilovolt-Ampere
KVAR	Kilovolt-Ampere Reactive
KW	Kilowatt
KWH	Kilowatt Hour
LOC	Locate Or Location
LT	Light
LTG	Lighting
LTNG	Lightning
LV	Low Voltage
MAX	Maximum
MAG.S	Magnetic Starter
M/C	Momentary Contact
MC	Mechanical Contractor

MCB	Main Circuit Breaker
MCC	Motor Control Center
MDC	Main Distribution Center
MDP	Main Distribution Panel
MFR	Manufacturer
MFS	Main Fused Disconnect Switch
MH	Manhole
MIC	Microphone
MIN	Minimum
MISC	Miscellaneous
MLO	Main Lugs Only
MMS	Manual Motor Starter
MOA	Multioutlet Assembly
MSP	Motor Starter Panelboard
MSBD	Main Switchboard
MSS	Motor Starter Switch
MT	Mount
MT.C	Empty Conduit
MTS	Manual Transfer Switch
MTR	Motor, Motorized
N.C.	Normally Closed
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFDS	Non-Fused Safety Disconnect Switch
NIC	Not In Contract
NL	Night Light
N.O.	Normally Open
NPF	Normal Power Factor
NTS	Not To Scale
OC	On Center
OH	Overhead
OL	Overloads
PA	Public Address
PB	Pull Box Or Pushbutton
PE	Pneumatic Electric
PED	Pedestal
PF	Power Factor
PH	Phase
PIV	Post Indicating Valve
PNL	Panel
PP	Power Pole
PR	Pair
PRI	Primary
PROJ	Projection
PRV	Power Roof Ventilator
PT	Potential Transformer
PVC	Polyvinyl Chloride (Conduit)
PWR	Power
QUAN	Quantity
RCPT	Receptacle
REQD	Required
RM	Room
RSC	Rigid Steel Conduit
RTU	Roof Top Unit
SC	Surface Conduit
SEC	Secondary
SHT	Sheet
SIM	Similar
SLD	Single-Line Diagram
S/N	Solid Neutral
SPEC	Specification
SPKR	Speaker
SP	Spare
SPP	Single-Point Power
SR	Surface Raceway
SS	Stainless Steel
SSW	Selector Switch
S/S	Stop/Start Pushbuttons
STA	Station
STD	Standard
SURF	Surface Mounted
SW	Switch
SWBD	Switchboard
SYM	Symmetrical
SYS	System
TEL	Telephone
TERM	Terminal
TL	Twist Lock
TR	Tamper Resistant
T-STAT	Thermostat
TTC	Telephone Terminal Cabinet
TV	Television
TVTC	Television Terminal Cabinet
TYP	Typical
UC	Under Counter
UE	Underground Electrical
UG	Underground
UH	Unit Heater
UT	Underground Telephone
UTIL	Utility
UV	Ultraviolet
V	Volt
VA	Volt-Amperes
VDT	Video Display Terminal
VERT	Vertical
VFD	Variable Frequency Drive
VOL	Volume
W	Watt
W/	With
WG	Wire Guard
WH	Water Heater
W/O	Without
WP	Weatherproof
XFMR	Transformer
XFR	Transfer

∠	Angle
@	At
▲	Delta
'	Feet
"	Inches
#	Number
Ø	Phase
C	Center Line
P	Plate

Electrical Symbol Legend

Lighting Symbols

- Lighting Fixtures, Typical, Rectangular (Various Symbols) Filled circles indicate recessed. Open circles indicate surface-mounted. Diagonal line indicates lensed. Outer dots indicate suspended.
- Lighting Fixtures, Typical, Round (Various Symbols) Center dot indicates pendant. Diagonal line indicates lensed. Chevron indicates wall wash.
- Wall-mounted fixtures, Typical (Various Symbols)
- Strip Fixture
- Directional Light, Track Light, Flood Light
- Linear Light, Tape Light
- Emergency Lighting Unit, Ceiling-Mounted, Integral Battery
- Emergency Lighting Unit, Ceiling-Mounted, Remote Battery
- Emergency Lighting Unit, Wall-Mounted, Integral Battery
- Emergency Lighting Unit, Wall-Mounted, Remote Battery
- Exit Light, Ceiling-Mounted. Shading and arrows indicate faces and directional chevrons.
- Exit Light, Wall-Mounted. Shading and arrows indicate faces and directional chevrons.
- Exit/ELU Combo
- Pole/Area Lights
- Post-Top Area Light
- Bollard Light
- Diagonal hatch indicates light on a critical circuit.
- Solid hatch indicates light on an emergency or life safety circuit.
- Single-Pole Switch
- Two-Pole Switch
- Three-Pole Switch
- Switch Modifiers:
  - 3: 3-Way
  - 4: 4-Way
  - K: Keyed
  - D: Dimming
  - T: Timer
  - OS: Occupancy Sensor
  - VS: Vacancy Sensor
  - AC: Above-Counter
  - LV: Low-Voltage
  - M: Motor-Rated
- Lighting Contactor
- LC Lighting Control Panel
- OS Occupancy Sensor
- DL Daylight Harvesting Sensor

Lighting Tags

A / A1a

- Top Value: Fixture Type ID (Underlined)
- Bottom Value, Lowercase Letter: Switch ID
- Bottom Value, Number(s): Circuit Number
- Bottom Value, Uppercase Letter(s): Panel ID

Absence of a switch designation on a lighting fixture indicates fixture is controlled by the only switch in the space. An "x" in place of the switch designation indicates unswitched.

Switch ID indicated by a lowercase letter. Switch IDs are unique per space. A switch with an ID "a" controls all devices within the space in which it is located tagged with "a". A switch without a tagged ID controls all lighting fixtures within a space. ID tags may be used on control devices other than switches, such as occupancy sensors or contactors.

Grounding and Lightning Protection Symbols

- Ground Rod
- Ground Rod with Test Well
- Static Ground Receptacle
- Lightning Protection Air Terminal
- Lightning Protection Conductor Splice

Power Symbols

Wall / Ceiling / Floor

- Simplex Receptacle
- Duplex Receptacle
- Quadruplex Receptacle
- Special Receptacle, Type as Indicated
- Receptacle Modifiers:
  - ##": Height AFF OC
  - AC: Above Counter
  - GFI: Ground-Fault Circuit Interrupter
  - WP: Weatherproof In-Use Cover
- Half shading indicates split (typically switched)
- Outside shading indicates emergency circuit
- Center shading indicates isolated ground
- Single-Pole Switch
- Two-Pole Switch
- Three-Pole Switch
- Switch Modifiers:
  - K: Keyed
  - T: Timer
  - AC: Above-Counter
  - M: Motor-Rated
- Multioutlet Assembly. Filled squares indicate 120V outlet. Open squares indicate with USB
- Cord Reel, Device Varies
- Drop Cord, Device Varies
- Junction Box
- F1 Floor Box, see schedule for type
- Emergency Power Off
- DO Door Opener Push Plate
- M Power Meter
- Safety Switch, Fused
- Safety Switch, Unfused
- Motor Starter
- Combination Starter/Disconnect
- Contactor

Power Device and Equipment Tags

C1a — Electrical DeviceTags: Uppercase letter(s) indicates Panel ID and circuit number. Lowercase letter indicates designation of controlling switch (where applicable).

XX-1 — Equipment Tags: Equipment ID is indicated by an underlined tag adjacent to the equipment. See the equipment connection schedule for description, electrical requirements, and panel and circuit number. Symbols/graphic appearance of equipment varies.

Wiring

Solid, arced lines connecting equipment, devices, or fixtures indicate unswitched power circuiting. Wires are only intended to indicate to what circuit devices are connected. Actual connections, circuit routing, installtion, junction boxes, etc. shall be field-determined by the contractor.

Dashed, arced lines connecting equipment, devices, or fixtures indicate switched power.

Home run to branch circuit panelboard. The equipment name and circuit number(s) are indicated, separated by a hyphen. Homeruns are only intended to indicate panel and circuit number. Actual homerun location shall be field-determined by the contractor.

Power Distribution Equipment

SB1(S) MDP(A) HP1A(B) LP1A(C)

Hatched fill indicates distribution panel or switchboard.
Solid fill indicates branch panel or load center.
Dashed box indicates code-required clearance (width and depth).
Door indicates front of recessed panel.

Panelboards are assigned an abbreviated indicator (or Panel ID) for use with circuit numbers. Panel ID is listed within the panel schedule and in the panel abbreviation schedule.

Equipment is tagged with Panel Name and with Panel ID in parentheses. Panel ID is intended as a design documentation aid only. Do not include Panel ID in field-applied circuit directories or labels.

Devices and fixtures are tagged with Panel ID and circuit number. For example, a device tagged with "A1" indicates the device is circuited to panel designated "A," circuit number 1. The panel schedule circuit number contans both the panel abbreviation and the circuit number.

T1 — Transformer: Typically transformer names begin with or contain the letter "T". See Single-Line Diagram for description and requirements.

Telecom Symbols

Wall / Ceiling / Floor

- Data Outlet
- Telephone Outlet
- Data/Telephone Outlet
- Outlet Modifiers:
  - ##": Height AFF OC
  - AC: Above Counter
- Wireless Access Point
- TV Outlet

Nurse Call Symbols

- N — Nurse Call Corridor Light. Number of lights as indicated
- X — Nurse Call Device
  - B: Code Blue
  - D: Duty Station
  - E: Emergency
  - P: Patient Call
  - S: Staff
- XXXX — Nurse Call Control Unit
  - NCAP: Nurse Call Annunciator Panel
  - NCHS: Nurse Call Host Controller
  - NCPA: Nurse Call Power Supply
  - NCTC: Nurse Call Terminal Cabinet
  - NCUPS: Uninterruptable Power Supply

Security Symbols

- Security Camera
  - PTZ: Pan/Tilt/Zoom
- CR Card Reader
- CK Card Reader with Keypad
- TV CC Closed Circuit TV Outlet
- DC Door Contact
- ES Electric Strike
- IC Intercom
- ML Magnetic Lock
- RX Request to Exit Button
- REX Request to Exit Sensor
- MD Motion Detector
- XXX Security Control Unit
  - SCP: Security Control Panel
  - SPS: Security Power Supply Unit

Construction Phasing

(Typical All Symbols and Equipment)

- Existing to Remain
- Existing to Be Demolished
- New
- Existing to Be Demolished

Miscellaneous

- Area Not in Contract
- # Keynote
- Callout: Top Value: Detail Number on Sheet; Bottom Value: Sheet Number of Detail
- Room 1 — Room Name and Number

Fire Alarm Symbols

- F Manual Pull Station
- F Horn, Wall
- F Horn, Ceiling
- Strobe, Wall, Candela as indicated
- Strobe, Ceiling, Candela as indicated
- Horn/Strobe, Wall, Candela as indicated
- Horn/Strobe, Ceiling, Candela as indicated
- Remote Indicator w/ Test Switch, Wall
- Remote Indicate w/ Test Switch, Ceiling
- Smoke Detector
- Heat Detector
- CO Carbon Monoxide Detector
- T Beam Detector T: Transmitter R: Receiver
- Combination Detector (Up to Three)
- Duct Smoke Detector
- Smoke Damper
- DH Door Holder
- DCL Door Closer
- Fire Service Phone
- XXX Addressible Module
  - AIM: Addressible Input Module
  - AOM:Addressible Output Control Module
  - AIO: Addressible Input/Output Module
- XXXX Fire Alarm Control Unit
  - EVAC: Voice Evacuation Control Panel
  - FAA: Fire Alarm Annunciator
  - FACP: Fire Alarm Control Panel
  - FATC: Fire Alarm Terminal Cabinet
  - NACP: Notification Appliance Circuit Panel
  - FAMN: Fire Alarm Mass Notification Control Panel
- XX Supervisory or Interface Device
  - PIV: Post Indicator Valve Supervisory
  - PS: Pressure Switch
  - R: Non-Addressible Relay
  - VS: Valve Supervisory Switch
  - WF: Water Flow Switch

GENERAL NOTES:

1. ALL MOUNTING HEIGHTS SHOWN ARE FROM THE FINISHED FLOOR TO THE CENTERLINE OF THE DEVICE, UNLESS NOTED OTHERWISE.
2. ALL ELECTRICAL DEVICES SHALL BE ALIGNED WITH THE ARCHITECTURAL FEATURES OF THE BUILDING. DEVICES FOR VARIOUS SYSTEMS (LIGHT SWITCHES, RECEPTACLES, FIRE ALARM HORNS, THERMOSTATS, ETC.) LOCATED IN THE SAME GENERAL AREA SHALL BE ALIGNED AT THEIR RESPECTIVE MOUNTING HEIGHTS. THE ELECTRICAL CONTRACTOR SHALL COORDINATE WITH THE OTHER TRADES TO ENSURE ALIGNMENT OF ALL DEVICES. BACK BOXES SHALL BE MOUNTED ON THE SAME SIDE OF THE SAME WALL STUD TO PRESENT AN ALIGNED APPEARANCE. ANY DIMENSIONING SHOWN ON THE DRAWINGS SHALL SUPERSEDE THIS GUIDANCE. SEE DETAIL ON DRAWINGS FOR TYPICAL LOCATIONS AND MOUNTING HEIGHTS.
3. THE ELECTRICAL CONTRACTOR SHALL COORDINATE THE LOCATION OF EACH LIGHT FIXTURE WITH THE REFLECTED CEILING PLANS. FOR LIGHT FIXTURES INSTALLED IN MECHANICAL AREAS, THE ELECTRICAL CONTRACTOR SHALL COORDINATE EACH FIXTURE LOCATION TO AVOID CONFLICTS WITH THE MECHANICAL PIPING, EQUIPMENT, AND DUCTWORK. THE ELECTRICAL CONTRACTOR SHALL SUSPEND EACH FIXTURE TO A POINT JUST BELOW THE ADJACENT DUCTWORK AND LOCATE TO PERMIT ADEQUATE LIGHTING OF ALL EQUIPMENT. SOME EXISTING LIGHT FIXTURES ARE TO BE REUSED AND/OR RELOCATED FROM DEMOLITION. REFER TO THE PLANS FOR INDICATION OF NEW AND EXISTING. CLEAN AND RE-LAMP ALL EXISTING FIXTURES, WHICH REMAIN IN SERVICE.
4. WHERE DUAL-LEVEL SWITCHING FOR LIGHTING IS DENOTED, CIRCUIT INBOARD AND OUTBOARD LAMPS IN EACH LIGHT FIXTURE ON SEPARATE BALLASTS AND CONNECT TO THE RESPECTIVE SWITCHES SHOWN IN THE ROOM. SEE DETAIL ON DRAWINGS FOR DUAL-LEVEL SWITCHING DIAGRAM.
5. ELECTRIC WATER COOLER (EWC) RECEPTACLES AND CONNECTIONS SHALL BE INSTALLED OUT OF VIEW AND BEHIND THE ENCLOSURE OF DRINKING FOUNTAINS. VERIFY THE MOUNTING HEIGHT WITH THE EQUIPMENT SUPPLIER. RECEPTACLES FOR EWC'S SHALL BE GFCI.
6. WHERE A MULTIPLE-GANG BOX HAS CIRCUITS OF DIFFERENT VOLTAGES OR SYSTEMS WHICH ARE REQUIRED TO BE SEPARATED, THE BOX SHALL BE PROVIDED WITH THE CODE-REQUIRED SEPARATION USING A FULL HEIGHT AND DEPTH BARRIER PLATE.
7. WHERE AN INDIVIDUALLY MOUNTED SAFETY SWITCH, STARTER, OR CIRCUIT BREAKER IS SHOWN ADJACENT TO ITS RESPECTIVE LOAD AND NOT MOUNTED ON A WALL, THE ELECTRICAL CONTRACTOR SHALL PROVIDE ALL SUPPORTS, BRACKETS, ANCHORING, ETC. NECESSARY TO PROPERLY SUPPORT THE DEVICE.
8. MAGNETIC OR COMBINATION MAGNETIC STARTERS FOR MECHANICAL EQUIPMENT WHICH ARE NOT PART OF A MOTOR CONTROL CENTER SHALL BE FURNISHED BY THE MECHANICAL CONTRACTOR AND INSTALLED BY THE ELECTRICAL CONTRACTOR, UNLESS NOTED OTHERWISE.
9. MECHANICAL EQUIPMENT WILL BE FURNISHED AND INSTALLED BY THE MECHANICAL CONTRACTOR. THE LOCATIONS SHOWN ON THE ELECTRICAL PLANS ARE APPROXIMATE. THE ELECTRICAL CONTRACTOR SHALL FULLY COORDINATE WITH THE MECHANICAL CONTRACTOR TO DETERMINE THE EXACT LOCATION OF EACH PIECE OF EQUIPMENT.
10. WHERE COVER PLATES FOR LIGHT SWITCHES OR RECEPTACLES CONFLICT WITH CASEWORK OR MILLWORK, THE MOUNTING HEIGHTS OF THE WIRING DEVICES SHALL BE SLIGHTLY ADJUSTED SO THAT THE COVER PLATES CLEAR THE BACK SPLASH BY 1/4". THE ELECTRICAL CONTRACTOR SHALL THOROUGHLY REVIEW THE CASEWORK DRAWINGS AND ARCHITECTURAL ELEVATIONS PRIOR TO ROUGH-IN OF OUTLET BOXES.
11. SEE DETAIL SHEET(S) FOR TYPICAL INSTALLATION DETAILS.
12. FOR ANY WALL OR FLOOR PENETRATIONS MADE BY THE ELECTRICAL CONTRACTOR, THE ELECTRICAL CONTRACTOR SHALL PROVIDE FIRE PROOFING TO SEAL ALL THE PENETRATIONS AFTER THE NECESSARY CONDUIT OR OTHER EQUIPMENT HAS BEEN INSTALLED. FIRE PROOFING FOR PENETRATIONS SHALL BE UL APPROVED PER THE PENETRATION MADE. REFER TO ARCHITECTURAL SHEETS FOR LOCATIONS OF RATED WALLS AND PARTITIONS.
13. A LIGHTING FIXTURE WITH THE LABEL 'NL' INDICATES THAT THE FIXTURE SHALL BE CONNECTED, UNSWITCHED, TO THE LOCAL EMERGENCY LIGHTING CIRCUIT INDICATED FOR "NIGHT LIGHT" OPERATION.
14. ALL EXIT LIGHTS SHALL BE CONNECTED, UNSWITCHED, TO THE LOCAL EMERGENCY LIGHTING CIRCUIT INDICATED.
15. THE ELECTRICAL CONTRACTOR SHALL CONCEAL ALL CONDUIT AND WIRING IN WALL OR CEILING SPACES, EXCEPT IN UNFINISHED AREAS.
16. EXISTING DEVICES ARE SHOWN USING DASHED STANDARD SYMBOLS.
17. UNLESS NOTED OTHERWISE, EXISTING CONDUIT AND CONDUCTORS MAY BE REUSED WHERE THEY ARE OF THE TYPE SPECIFIED, MEET THE REQUIREMENTS OF NEW CIRCUITS, AND REMAIN IN GOOD CONDITION.
18. THE ELECTRICAL CONTRACTOR SHALL DISCONNECT ALL EXISTING EQUIPMENT SHOWN TO BE REMOVED AND SHALL REMOVE ALL DISCONNECTS, STARTERS, CONDUIT, AND CONDUCTORS THAT SHALL NOT REMAIN IN PLACE. THE ELECTRICAL CONTRACTOR SHALL LEAVE ALL MODIFIED CIRCUITS IN A SAFE CONDITION.
19. FOR EQUIPMENT SHOWN OR DENOTED TO BE RELOCATED BY OTHERS, THE ELECTRICAL POWER CONNECTIONS SHALL BE MADE BY THE CONTRACTOR RESPONSIBLE FOR THAT EQUIPMENT. THE ELECTRICAL CONTRACTOR SHALL PROVIDE LINE SIDE TERMINATIONS AT THE APPROPRIATE TERMINATION POINT AS IDENTIFIED IN THE SPECIFICATIONS.
20. THE ELECTRICAL CONTRACTOR SHALL REMOVE THE CONDUCTORS TO ALL EXISTING LIGHT FIXTURES AND DEVICES SHOWN TO BE REMOVED. MODIFY CIRCUITS TO MAINTAIN CONTINUITY OF SERVICE AND GROUNDING TO EXISTING LOADS SHOWN TO REMAIN OR TO OTHER LOADS LOCATED IN OTHER AREAS OF THE BUILDING NOT INCLUDED IN THIS WORK. PROVIDE A REVISED TYPED DIRECTORY FOR PANELS IN WHICH THERE HAVE BEEN CHANGES.
21. IN RENOVATED AREAS, THE ELECTRICAL CONTRACTOR SHALL REPLACE ALL EXISTING RECEPTACLES AND SWITCHES SHOWN TO REMAIN WITH NEW DEVICES WHICH MATCH THE DEVICES SHOWN TO BE INSTALLED ELSEWHERE IN THE AREA. PROVIDE NEW COVER PLATES AND EXTEND OUTLET BOXES AS REQUIRED FOR ALL NEW FINISHES.
22. PROVIDE ALL ACCESS PANELS AND ACCESS DOORS WHERE REQUIRED FOR SERVICING AND ADJUSTING ALL EQUIPMENT IN NON-ACCESSIBLE LOCATIONS. THE LOCATIONS OF ACCESS PANELS AND DOORS ARE NOT SHOWN IN ORDER TO MAINTAIN DRAWING CLARITY AND TO ACCOMMODATE THE METHODS AND MEANS OF CONSTRUCTION. ACCESS PANELS AND DOORS ARE SPECIFIED IN DIVISION 8 OF THE PROJECT MANUAL.
23. ALL WORK SHOWN ON THE DRAWINGS IS NEW, UNLESS SPECIFICALLY INDICATED AS EXISTING.
24. EXISTING CONDUIT MAY BE REUSED IN EXISTING LOCATION FROM DEMOLITION IF IN GOOD CONDITION AND FEASIBLE FOR NEW WORK. REMOVE ALL UNUSED CONDUIT, PER DEMOLITION NOTES.
25. ALL EXISTING FIRE ALARM DEVICES ARE TO REMAIN IN SERVICE. E/C TO SECURE, COVER, PROTECT DURING CONSTRUCTION PERIOD. WHERE CEILING ARE TO BE REPLACED E/C TO REMOUNT DEVICES IN NEW CEILING. SEE ARCHITECTURAL PLANS FOR EXTENT OF CEILING WORK TO BE PERFORMED AND COORDINATE WITH GENERAL AND CEILING CONTRACTOR.
26. SMOKE DETECTORS FOR AIR HANDLING UNITS SHALL BE LOCATED IN AIR DUCTS OBSERVING ALL APPLICABLE CODES AND ORDINANCES. ELECTRICAL CONTRACTOR SHALL FURNISH DUCT SMOKE DETECTORS TO THE MECHANICAL CONTRACTOR FOR INSTALLATION. THE MECHANICAL CONTRACTOR SHALL INSTALL DUCT SMOKE DETECTORS AND PROVIDE ASSOCIATED ACCESS DOOR. ELECTRICAL CONTRACTOR WILL CONNECT THE DUCT SMOKE DETECTORS TO THE FIRE ALARM SYSTEM. LOCATE THE DETECTOR INDICATOR/RESET DEVICE IN AN ACCESSIBLE LOCATION PER SPECIFICATIONS, OR AS DIRECTED BY THE ARCHITECT. LABEL AS TO AREA AND UNIT SERVED, TYPICAL.
27. 20 AMP SINGLE PHASE BRANCH CIRCUIT WIRE SIZING SHALL BE IN ACCORD WITH THE FOLLOWING TABLE:

VOLTS	DISTANCE	HOME RUN	REMAINDER OF CIRCUIT	GROUND
120V	0' - 60'	#12	#12	#12
	60' - 100'	#10	#12	#10
	100' - 150'	# 8	#10	#10

28. THE EXISTING PORTIONS OF THIS FACILITY WILL REMAIN IN OPERATION DURING THIS CONSTRUCTION. CONTRACTOR SHALL COOPERATE FULLY WITH THE ADMINISTRATION IN ORDER TO CAUSE AS LITTLE DISRUPTION AS POSSIBLE TO THE FUNCTIONING OF THE FACILITY, AND TO MAINTAIN THE COMFORT AND SAFETY OF THE PUBLIC AND STAFF.
29. THIS PROJECT INVOLVES WORK IN EXISTING PORTIONS OF THE FACILITY. EXISTING FEEDERS, BRANCH CIRCUITS, COMMUNICATIONS, RACEWAYS, ETC. WHICH ARE DISRUPTED BY THIS PROJECT SHALL BE RE-ROUTED AND/OR RE-FED FROM A NEW SOURCE AS REQUIRED TO MAINTAIN THEM IN FULL AND PERMANENT SERVICE. THE CONTRACTOR SHOULD VISIT THE SITE PRIOR TO BIDDING TO REVIEW EXISTING CONDITIONS. CONTRACTOR SHALL NOT BE EXCUSED FROM PERFORMING REQUIRED WORK BECAUSE HE DID NOT VISIT THE SITE.
30. EXISTING CONDUIT RUNS, EQUIPMENT AND OUTLET LOCATIONS HAVE BEEN TAKEN FROM EXISTING DRAWINGS FURNISHED BY THE OWNER AND LIMITED SITE VISIT, ALL INFORMATION SHALL BE FIELD VERIFIED ON THE JOB SITE, BEFORE PROCEEDING WITH CONSTRUCTION.

NOTES:

1) MOUNT AT 20" AFF TO TOP -U.O.N.- ADJUST TO MATCH MASONRY COURSES IF APPLICABLE. MOUNT ALL BOXES TRUE AND PLUMB.

2) MOUNT AT 6" ABOVE COUNTERTOP OR BACKSPLASH AS APPLICABLE TO TOP OF BOX. ADJUST TO MATCH MASONRY COURSES IF APPLICABLE. MOUNT ALL BOXES TRUE AND PLUMB.

3) MOUNT AT 48" AFF TO TOP - ADJUST TO MATCH MASONRY COURSES IF APPLICABLE. MOUNT ALL BOXES TRUE AND PLUMB.

4) MOUNT ALL PULL STATIONS 48" AFF TO TOP. MOUNT ALL HORN/STROBES, STROBES, AND REMOTE ALARM INDICATORS 80" AFF TO TOP. COORDINATE LOCATION OF FAN CONTROL RELAY WITH H.C. PROVIDE DUCT DETECTORS TO H.C. FOR MOUNTING. ALL WIRING BY E.C. WIRE DUCT DETECTORS TO REMOTE ALARM INDICATORS IN CORRIDORS. COORDINATE LOCATIONS OF MAGNETIC DOOR HOLDERS WITH G.C. ADJUST ALL MOUNTING HEIGHTS TO MATCH MASONRY COURSES IN APPLICABLE. MOUNT ALL BOXES TRUE AND PLUMB.

5) MOUNT ALL TELEPHONE OUTLETS AT 20" AFF TO TOP -U.O.N.- ADJUST TO MATCH MASONRY COURSES IF APPLICABLE. MOUNT ALL BOXES TRUE AND PLUMB.

6) MOUNT ALL WALL MOUNTED COMPUTER OUTLETS AT 20" AFF TO TOP -U.O.N.- ADJUST TO MATCH MASONRY COURSES IF APPLICABLE. FOR WALL MOUNT PROVIDE A 4" SQUARE DEEP BOX WITH A SINGLE GANG RING. FOR FLOOR AND WALL MOUNT PROVIDE A 1" C. FROM EACH BOX AND STUB ABOVE LAY-IN CEILING. PROVIDE A THROATED CONNECTOR AT BOTH ENDS OF CONDUIT. MOUNT ALL BOXES TRUE AND PLUMB.

7) MOUNT ALL CALL SWITCHES AND AREA VOLUME CONTROLS 48" AFF TO TOP. ADJUST TO MATCH MASONRY COURSES IF APPLICABLE. MOUNT ALL BOXES TRUE AND PLUMB.

8) COORDINATE THE LOCATIONS OF ALL DEVICES WITH CHALKBOARDS, TACKBOARDS, CABINET WORK, FURNITURE, PENCIL SHARPENERS, AND OTHER DEVICES. REVIEW ALL PLANS CAREFULLY AND RESOLVE ANY AND ALL QUESTIONS BEFORE PROCEEDING WITH INSTALLATION.

APPENDIX B
2018 BUILDING CODE SUMMARY
FOR ALL COMMERCIAL PROJECTS
ELECTRICAL DESIGN
ELECTRICAL SUMMARY

ELECTRICAL SYSTEM AND EQUIPMENT

Method of Compliance:

- Energy Code: ☐ Presciptive ☐ Performance
- ASHRAE 90.1: ☒ Presciptive ☐ Performance

Lighting schedule (each fixture type)

lamp type required in fixture	LED
number of lamps in fixture	REFER TO LUMINAIRE SCHEDULE
ballast type used in the fixture	REFER TO LUMINAIRE SCHEDULE
number of ballasts in fixture	REFER TO LUMINAIRE SCHEDULE
total wattage per fixture	REFER TO LUMINAIRE SCHEDULE
total interior wattage specified versus allowed (whole building or space by space)	798/933
total exterior wattage specified versus allowed	112/400

Additional Prescriptive Compliance

- ☐ C406.2 More Efficient Mechanical Equipment
- ☐ C406.3 Reduced Lighting Power Density
- ☐ C406.4 Enhanced Lighting Controls
- ☐ C406.5 On-Site Supply of Renewable Energy
- ☐ C406.6 Provision of a Dedicated Outdoor Air System
- ☐ C406.7 Higher Efficiency Service Water Heating

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036840 NICHOLAS C. HUFFMAN

SIGNED AND DATED:
Nick Huffman

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Electrical Sheet List

E001	GENERAL ELECTRICAL INFORMATION
E101	ELECTRICAL SITE PLAN
E201	POWER AND LIGHTING PLANS
E501	ELECTRICAL DETAILS
E601	ELECTRICAL ONE-LINES AND SCHEDULES

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Architect: XXXXXX
Arch. Reg. No.: XXXX
Date: XX/XX/XXXX

KEY PLAN

REVISION

NO.	DESCRIPTION	DATE

DATE
08/20/26

ISSUE
CONSTRUCTION DRAWINGS ISSUE

SHEET TITLE
GENERAL ELECTRICAL INFORMATION

SHEET NO.
E001

MODEL: P:\Revit\Sonja\26.00701 - Operators Bldg - MEP V26_Central Model_sonja.roberts.rvt
TEMPLATE VERSION:

PROJECT:	OPERATORS BUILDING
CLIENT:	CATAWBA COUNTY
PROJECT #:	26.00701
DATE:	7/22/2026

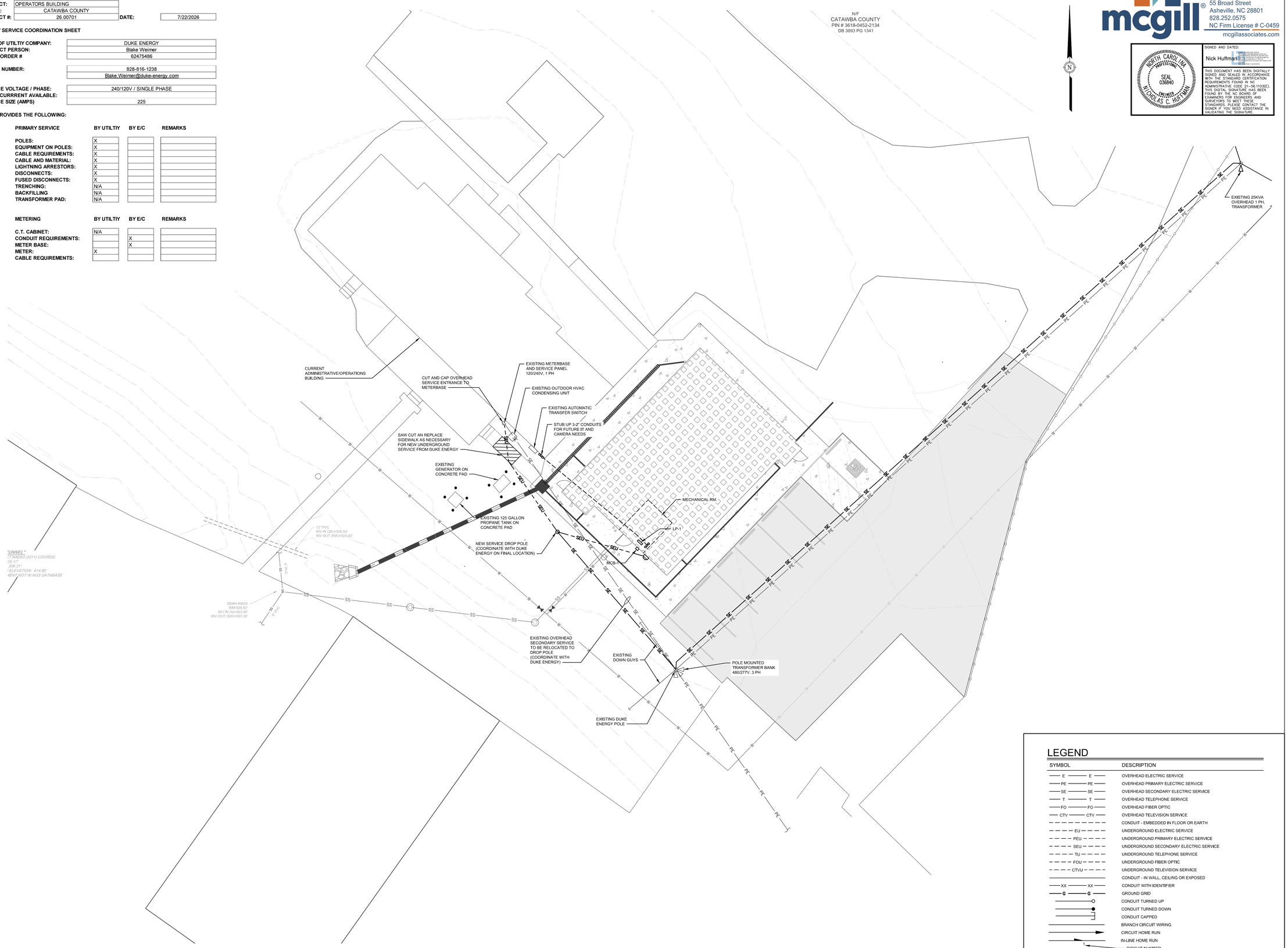
UTILTIY SERVICE COORDINATION SHEET

NAME OF UTILTIY COMPANY:	DUKE ENERGY
CONTACT PERSON:	Blake Weimer
WORK ORDER #	62475486
PHONE NUMBER:	828-816-1238
EMAIL:	Blake.Weimer@duke-energy.com
SERVICE VOLTAGE / PHASE:	240/120V / SINGLE PHASE
FAULT CURRRENT AVAILABLE:	
SERVICE SIZE (AMPS)	225

WHO PROVIDES THE FOLLOWING:

PRIMARY SERVICE	BY UTILTIY	BY E/C	REMARKS
POLES:	X		
EQUIPMENT ON POLES:	X		
CABLE REQUIREMENTS:	X		
CABLE AND MATERIAL:	X		
LIGHTNING ARRESTORS:	X		
DISCONNECTS:	X		
FUSED DISCONNECTS:	X		
TRENCHING:	N/A		
BACKFILLING	N/A		
TRANSFORMER PAD:	N/A		

METERING	BY UTILTIY	BY E/C	REMARKS
C.T. CABINET:	N/A		
CONDUIT REQUIREMENTS:		X	
METER BASE:		X	
METER:	X		
CABLE REQUIREMENTS:			



ELECTRICAL SITE PLAN

SCALE: 1"=10'-0"

10 0 5 10 20

GRAPHIC SCALE DIVISION VALUE = 10 FEET

LEGEND

SYMBOL	DESCRIPTION
E — E	OVERHEAD ELECTRIC SERVICE
PE — PE	OVERHEAD PRIMARY ELECTRIC SERVICE
SE — SE	OVERHEAD SECONDARY ELECTRIC SERVICE
T — T	OVERHEAD TELEPHONE SERVICE
FO — FO	OVERHEAD FIBER OPTIC
CTV — CTV	OVERHEAD TELEVISION SERVICE
	CONDUIT - EMBEDDED IN FLOOR OR EARTH
EU	UNDERGROUND ELECTRIC SERVICE
PEU	UNDERGROUND PRIMARY ELECTRIC SERVICE
SEU	UNDERGROUND SECONDARY ELECTRIC SERVICE
TU	UNDERGROUND TELEPHONE SERVICE
FOU	UNDERGROUND FIBER OPTIC
CTVU	UNDERGROUND TELEVISION SERVICE
	CONDUIT - IN WALL, CEILING OR EXPOSED
XX — XX	CONDUIT WITH IDENTIFIER
G — G	GROUND GRID
	CONDUIT TURNED UP
	CONDUIT TURNED DOWN
	CONDUIT CAPPED
	BRANCH CIRCUIT WIRING
	CIRCUIT HOME RUN
1	IN-LINE HOME RUN
	CIRCUIT NUMBER
E — E	EMERGENCY ONLY CIRCUIT
NE — NE	NORMAL EMERGENCY CIRCUIT
//	DEVICES ON SAME CIRCUIT, SEPARATELY CONTROLLED

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SIGNED AND DATED:
Nick Huffman

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Arch. Reg. No.: XXXX
Date: XX/XX/XXXX

KEY PLAN

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NO.	DESCRIPTION	DATE

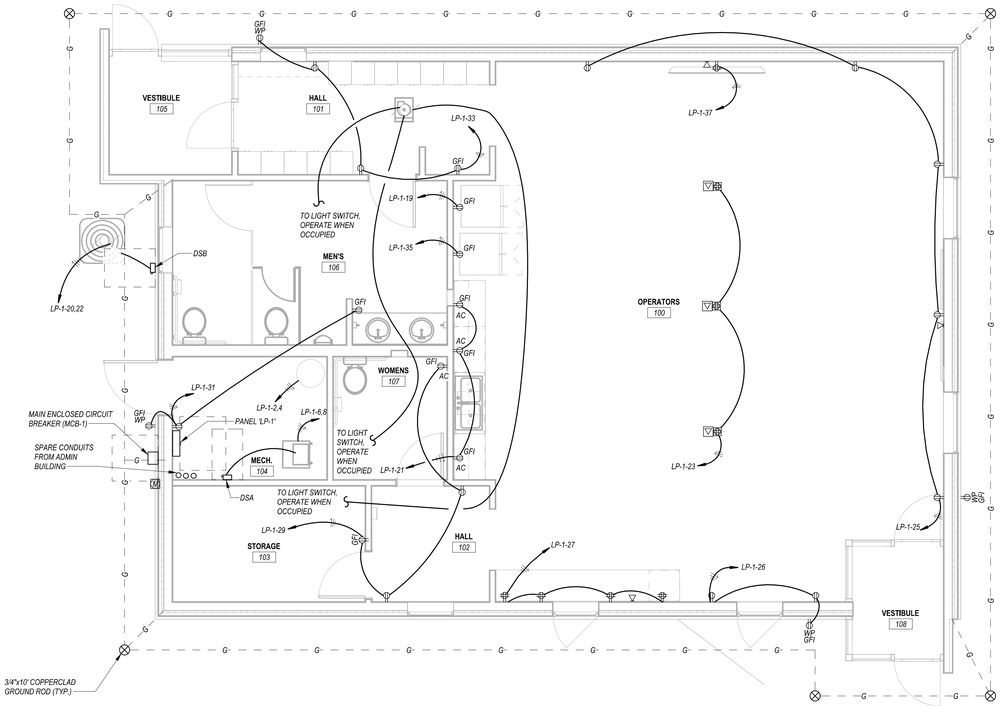
DATE
08/20/26

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CONSTRUCTION DRAWINGS ISSUE

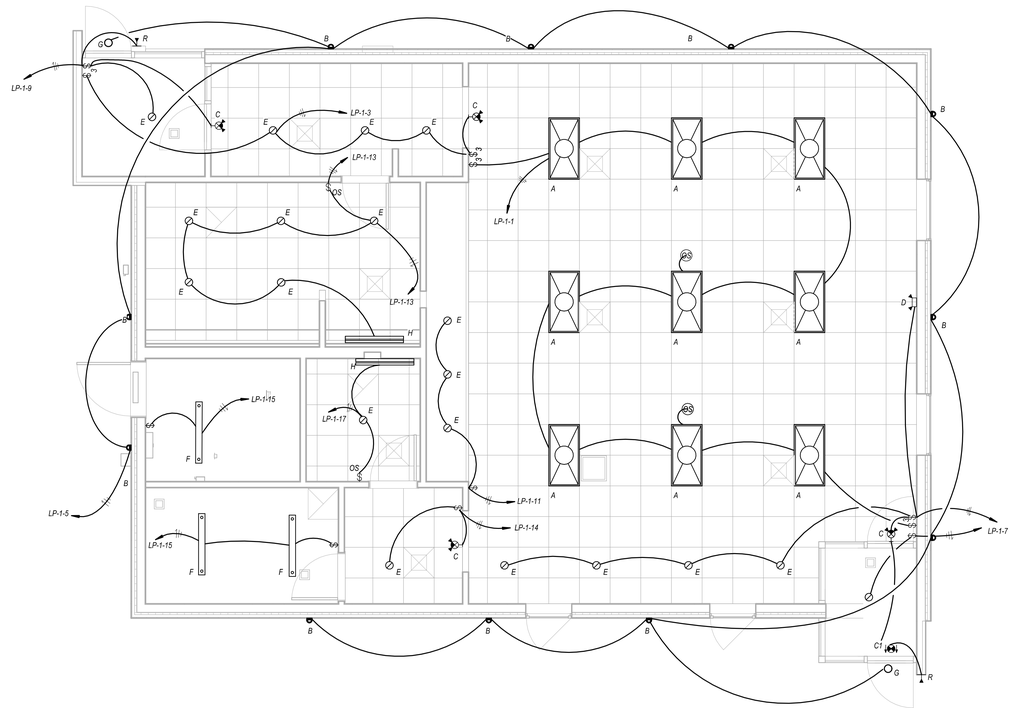
SHEET TITLE
ELECTRICAL SITE PLAN

SHEET NO.
E101

TEMPLATE VERSION: June 9, 2026 MODEL: P:\2026\26.00701-CATAWBACONC-OPERATORS BUILDING\DRAWINGS\SHEETS\26.00701 - ELECTRICAL SITE PLAN.DWG



1 E201 POWER PLAN
1/4" = 1'-0"
0 2' 4' 6'



2 E201 LIGHTING PLAN
1/4" = 1'-0"
0 2' 4' 6'

TEMPLATE VERSION:
MODEL: P:\Revit\Scopi\26.03701 - Operations Bldg - MEP (26)_Central Model_scopi.roberts.rvt

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NORTH CAROLINA
SEAL 036840
ENGINEER
MICHAEL S. C. HUFFMAN

SIGNED AND DATED:
Nick Huffman

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Arch. Reg. No.: XXXX
Date: XX/XX/XXXX

KEY PLAN

REVISION

NO.	DESCRIPTION	DATE

DATE
8/20/26

ISSUE
CONSTRUCTION DRAWINGS ISSUE

SHEET TITLE
POWER AND LIGHTING PLANS

SHEET NO.
E201

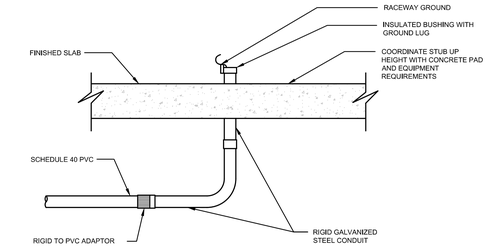
PANEL "A"
120/208V, 3Ø4W, 225A FED
FROM MDP-21
AVAILABLE FAULT CURRENT xxxxA
CALCULATED 12/23/2016

DISC AHU#1
120/208V, 3Ø4W, 100A FED FROM
MDP-14
12/23/2016

PANEL "AA"
120/208V, 3Ø4W, 225A SUB-FED FROM
PANEL "A"
AVAILABLE FAULT CURRENT xxxxA
CALCULATED 12/23/2016

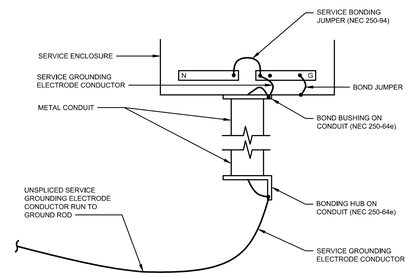
NOTES:
1. REFER TO SPECIFICATION SECTION 260553 FOR ADDITIONAL INFORMATION.
2. SUBMIT COMPLETE LIST OF PROPOSED NAMEPLATES TO ARCHITECT/ENGINEER FOR APPROVAL PRIOR TO FABRICATION.

1 E501 TYPICAL NAME PLATE DETAIL
NOT TO SCALE

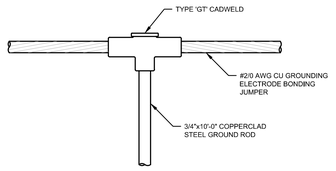


NOTES
1. THIS DETAIL APPLIES TO ALL UNDERGROUND CONDUITS WHERE PVC IS UTILIZED. PVC SHALL NOT BE EXTENDED ABOVE GRADE UNLESS SPECIFICALLY APPROVED.

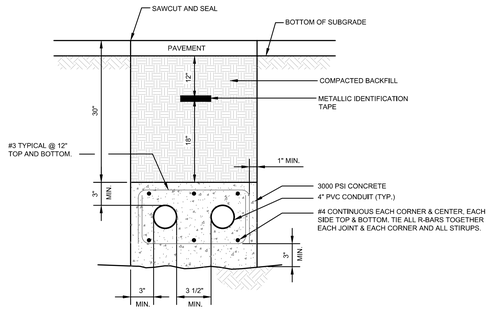
2 E501 TYPICAL CONDUIT STUB UP
NOT TO SCALE



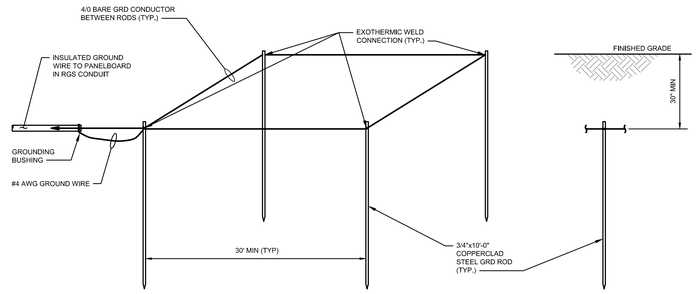
3 E501 SERVICE ENTRANCE EQUIPMENT GROUNDING
NOT TO SCALE



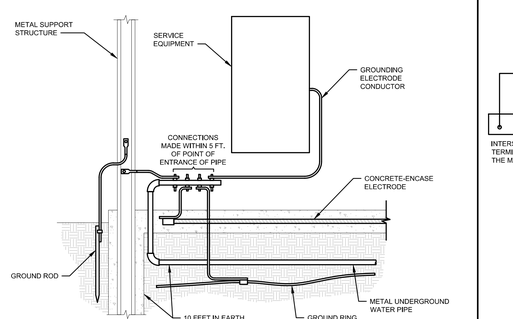
4 E501 CABLE TO GROUND ROD CONNECTION
NOT TO SCALE



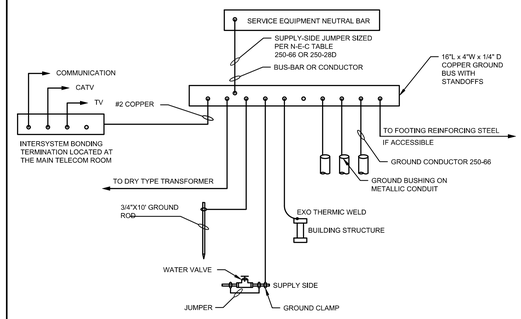
5 E501 TYPICAL CONCRETE ENCASED DUCTBANK UNDER PAVEMENT DETAIL
NOT TO SCALE



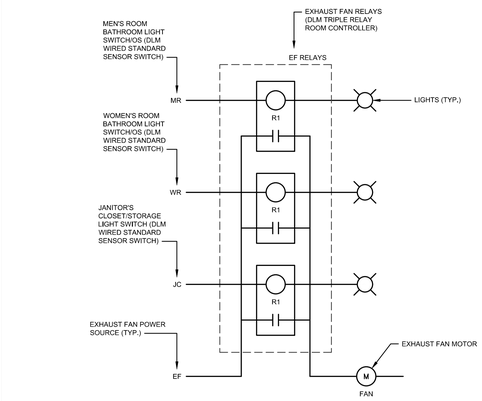
6 E501 GROUNDING COUNTERPOISE DETAIL
NOT TO SCALE



7 E501 EQUIPMENT GROUNDING CONNECTION DETAIL
NOT TO SCALE



8 E501 SERVICE EQUIPMENT GROUNDING DETAIL
NOT TO SCALE



9 E501 RESTROOM & JANITOR'S CLOSET EXHAUST FAN - DETAIL
NOT TO SCALE

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036840 MICHAEL S. C. HUFFMAN

SIGNED AND DATED:
Nick Huffman

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ARCHITECT

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Arch. Reg. No.: XXXX
Date: XX/XX/XXXX

KEY PLAN

REVISION

NO.	DESCRIPTION	DATE

DATE
08/20/26

ISSUE
CONSTRUCTION DRAWINGS ISSUE

SHEET TITLE
ELECTRICAL DETAILS

SHEET NO.
E501

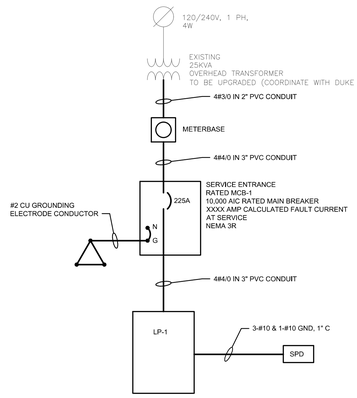
TEMPLATE VERSION May 29, 2026 MODEL: P:\2026\26.0070-CATAWBACONC-OPERATOR'S BUILDING\DRAWING\SHEETS\26.0070 1 - ELECTRICAL DETAILS AND SCHEDULES.DWG

LUMINAIRE SCHEDULE

TYPE	MANUFACTURER	MODEL NO.	INPUT WATTS	MT. HEIGHT	REMARKS	VOLTS
A	LITHONIA WILLIAMS OR EQUAL	STAKS 2X4 ALO6 SWW7	28 - 43	GRID	2'X4' INDOOR TROFFER - ADJUSTABLE LUMEN OUTPUT 4000LM/5000LM/6000LM AND ADJUSTABLE CCT 35K/40K/50K	120
B	WAC OR EQUAL	WS-W190212 4000K-80	20	See Arch.	CYLINDER 2 LIGHT UP/DOWN 12" TALL LED OUTDOOR WALL SCONCE, 1500LM, 80 CRI, 4K	120
C	EMERGI-LITE DUAL LITE OR EQUAL	ELXN400-R-2LED	2	8'	EXIT SIGNAGE WITH LED HEADS - PROVIDE WITH REMOTE MOUNT HEAD FOR EXTERIOR MOUNTING	MVOLT
C1	EMERGI-LITE DUAL LITE OR EQUAL	ELXN400-R-2LED	2	8'	EXIT SIGNAGE	MVOLT
D	LITHONIA MULE LIGHTING OR EQUAL	ELM6L HEPM SERIES	11	9'	EMERGENCY LIGHT WITH BATTERY BACKUP - MINIMUM 1,000 LUMENS	MVOLT
E	PRESCOLITE LIGHTOLIER OR EQUAL	LTR-4RD-H-SL10L-DM1-LTR-4RD-T-SL35K8WD-WC	19	GRID	4" LED OPEN DOWNLIGHT, WIDE BEAM DISTRIBUTION 1000 LUMENS, 3500K, 80 CRI, PAINTED WHITE CONE AND FLANGE - RECESSED	120
F	WILLIAMS NEW STAR LITHONIA	76R-4-L52/835-DIM-UNV VIC4N-L2351C-RW-UN-WH CSS L48 ALO3 MVOLT SWW3 80CRI	32	10'	1'x4' SEALED STRIP LED 4000 LUMENS, 3500K, 80 CRI	120
G	JUNO OR EQUAL	WF6 ALO20 SWW5 90CRI MW M6	16	Overhang	6" WAFER-THIN DOWNLIGHT WITH ADJUSTABLE CCT (2700K/3000K/3500K/4000K/5000K) AND LUMEN OUTPUT (800/1050/1300 LM) .WET LOCATION LISTED	120
H	WILLIAMS OR EQUAL	WMAUD - 4 - L40/835U/L40/835D - AF - UNV	64	WALL	ARCHITECTURAL WALL MOUNT UP/DOWN, 4', 4000 LM, 80 CRI	

DISCONNECT SWITCH SCHEDULE (ALL SWITCHES HEAVY DUTY)

DESIGN	MANUFACTURER		POLE	FUSE	NON-FUSE	NEMA	MOUNTING
	VOLT	AMP					
DSA	240V	60	2	X		1	SURFACE
DSB	240V	30	2	X		3R	SURFACE



POWER ONE-LINE
NOT TO SCALE

PANEL LP-1 BUS AMP 225A MIN. A.I.C. 10,000 MAIN BREAKER 225
MOUNTING SURFACE PHASE 1 WIRE 3 VOLTAGE 120/240
LOCATION MECHANICAL RM NEMA TYPE 1 BUS MATERIAl CU
PANELBOARD TYPE NON-FEED MAIN TYPE MCB TRIM TYPE FLUSHED - HINGED

CKT	DESCRIPTION	BREAKER		LOAD (KW)		WIRE		GND	COND	COND	GND	WIRE		LOAD (KW)		BREAKER		DESCRIPTION	CKT
		AMP	POLES	A	B	NO	SIZE	SIZE	SIZE	SIZE	SIZE	SIZE	NO	A	B	POLES	AMP		
1	LIGHTS - OPERATORS 100	20	1	0.74		2	12	12	3/4	3/4	10	10	3	1.6		2	30	WATER HEATER	2
3	LIGHTS - HALL	20	1		0.18	2	12	12	3/4						1.6				4
5	LIGHTS - EXTERIOR	20	1	0.36		2	12	12	3/4	1	10	4	3	4.05		2	60	AIR HANDLING UNIT (AHU-1)	6
7	LIGHTS - OPERATORS/ ENTRY	20	1		0.32	2		12	3/4						4.05				8
9	LIGHTS - ENTRY	20	1	0.08		2	12	12	3/4					-		1	20	SPARE	10
11	LIGHTS - KITCHEN	20	1		0.06	2	12	12	3/4						-	1	20	SPARE	12
13	LIGHTS - MENS ROOM	20	1	0.18		2	12	12	3/4	3/4	12	12	2	0.05		1	20	LIGHTING - HALL	14
15	LIGHTS - STORAGE/ MECH. RM	20	1		0.1	2	12	12	3/4	3/4	12	12	2		0.09	1	20	LIGHTING - OPERATOR 100	16
17	LIGHTS - WOMENS RM	20	1	0.02		2	12	12	3/4					-		1	20	SPARE	18
19	REFRIGERATOR	20	1		0.43	2	12	12	3/4	1	10	4	3		5.4	2	60	CONDENSING UNIT (CU-1)	20
21	KITCHEN RECEPTACLES	20	1	0.11		2	12	12	3/4					5.4					22
23	RECEPT FLOOR - OPERATORS	20	1		0.11	2	12	12	3/4	3/4	12	12	2		0.54	1	20	RECEPTACLES - OPERATORS 100	24
25	RECEPT - OPEATORS WALL	20	1	0.18		2	12	12	3/4	3/4	12	12	2	0.18		1	20	RECEPTACLES - OPERATORS 100	26
27	RECEPTACLES - OPERATORS 100	20	1		0.22	2	12	12	3/4										28
29	RECEPT WOMENS/STOR RM/HALL	20	1	0.14		2	12	12	3/4					-		1	20	SPARE	30
31	RECEPT. MECH / MEN'S RM	20	1		0.11	2	12	12	3/4						-	1	20	SPARE	32
33	RECEPT HALL/ EXT	20	1	0.14		2	12	12	3/4					-		1	20	SPARE	34
35	REFRIGERATOR	20	1		0.43	2	12	12	3/4						-	1	20	SPARE	36
37	TV RECEPT	20	1	-		2	12	12	3/4					-		1	20	SPARE	38
39	SPARE	20	1		-					3/4	10	10	3		-	2	30	TVSS (100kA)	40
41	SPARE	20	1	-										-					42
	SUB-TOTAL LOAD KW			1.97	1.96						SUB-TOTAL LOAD KW			11.3	11.7				
											TOTAL LOAD KW			13.2	13.6				

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NORTH CAROLINA PROFESSIONAL SEAL 036840 ENGINEER NICHOLAS C. HUFFMAN

SIGNED AND DATED:
Nick Huffman

THIS DOCUMENT HAS BEEN DIGITALLY SIGNED AND SEALED IN ACCORDANCE WITH THE STANDARD CERTIFICATION REQUIREMENTS FOUND IN NC ADMINISTRATIVE CODE 21--56.1103(E). THIS DIGITAL SIGNATURE HAS BEEN FOUND BY THE NC BOARD OF EXAMINERS FOR ENGINEERS AND SURVEYORS TO MEET THESE STANDARDS. PLEASE CONTACT THE SIGNER IF YOU NEED ASSISTANCE IN VALIDATING THE SIGNATURE.

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ARCHITECT

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NEW OPERATORS BUILDING FOR CATAWBA COUNTY LANDFILL

4017 ROCKY FORD RD, NEWTON, NC 28658

INTERIM REVIEW ONLY

These documents are incomplete, and are released for interim review only and are not intended for regulatory approval, permit, or construction purposes.

Architect: XXXXXX
Arch. Reg. No.: XXXX
Date: XX/XX/XXXX

KEY PLAN

REVISION

NO.	DESCRIPTION	DATE

DATE
08/20/26

ISSUE
CONSTRUCTION DRAWINGS ISSUE

SHEET TITLE
ELECTRICAL ONE-LINES AND SCHEDULES

SHEET NO.
E601

TEMPLATE VERSION May 29, 2026 MODEL: P:\2026\26.0070-CATAWBACONC-OPERATOR'S BUILDING\DRAWINGS\SHEETS\26.0070 - ELECTRICAL DETAILS AND SCHEDULES.DWG