

PROJECT MANUAL FOR

Addition to Thanksgiving Elementary School

Johnston County Schools

Johnston County, North Carolina

Hite associates

ARCHITECTURE / PLANNING / TECHNOLOGY

2600 Meridian Drive / Greenville, NC 27834 / tel 252.757.0333 / www.hiteassoc.com

CIVIL ENGINEERING CONSULTANT: Rivers and Associates, Inc.

107 East 2nd Street, Greenville, NC 27858, (252) 752-4135

STRUCTURAL ENGINEERING CONSULTANT: Queen Engineering & Design, P.A.

5530 Munford Road, Raleigh, NC 27612, (919) 420-0480

MECHANICAL / ELECTRICAL ENGINEERING CONSULTANT: Engineering Source of NC, P.A.

102-A2 Regency Blvd., Greenville, NC 27859, (252) 439-0338

March 2025

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NOTICE TO BIDDERS

Sealed proposals from selected bidders will be received by Johnston County Schools, at the offices of Facilities Services, 601A West Market Street, Smithfield, NC 27577 on April 22, 2025, at 3:00PM for the furnishing of labor, material and equipment entering into the construction of the **Addition to Thanksgiving Elementary School**. Bids shall be marked "SEALED BID", addressed to the attention of Mr. Matthew Johnson, Johnston County Schools, and shall include the Name, Address, and License Number of the Bidder, and the type of proposal enclosed.

Bids will be received as follows:

1. Single Prime Contract (site, general, plumbing, mechanical, and electrical)

Complete plans, specifications and contract documents are available on the Hite Associates website, www.hiteassoc.com ; and will be open for inspection in the office of the Architect, Hite Associates, 2600 Meridian Drive, Greenville, North Carolina, 27834, and; may be obtained for purchase by calling Speedyblue Reprographics at (252) 758-1616, print@speedyblue.com.

There will be a Pre-Bid Conference for on April 8, 2025, at 9:00 AM at project location, Thanksgiving Elementary School, 1161 Lynch Road, Selma, NC 27576.

All Contractors are hereby notified that they must have proper license under the State laws governing their respective trades.

General Contractors are notified that Chapter 87, Article I, General Statutes of North Carolina, will be observed in receiving bids and awarding the General Contract. General Contractors submitting bids on this project must have proper license classification.

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company insured by the Federal Deposit Insurance Corporation, of an amount equal to not less than five percent (5%) of the proposal, or in lieu thereof, a bidder may offer a bid bond of five percent (5%) of the bid executed by a surety company licensed under the laws of North Carolina to execute such bonds, conditioned that the surety will, upon demand forthwith make payment to the obligee upon said bond if the bidder fails to execute the contract in accordance with the bid bond. Said deposit shall be retained by the Owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten days after the award or to give satisfactory surety as required by law. In determining the value of the bid bond, additive or deductive alternates shall be considered as they are accepted by the Owner.

A Performance Bond and a Labor and Materials Payment Bond will be required for one hundred percent (100%) of the contract price.

NOTICE TO BIDDERS

Payment will be made on the basis of ninety-five percent (95%) of monthly estimates and final payment made upon completion and acceptance of work.

No bid may be withdrawn after the scheduled closing time for the receipt of bids for a period of 90 days after the bid date.

The Owner reserves the right to reject any or all bids and to waive informalities.

SIGNED: Mr. Matthew Johnson, Construction Manager
Johnston County Schools
Smithfield, North Carolina

DESIGNER: HITE ASSOCIATES, P.C.
2600 Meridian Drive
Greenville, North Carolina 27834

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AIA® Document A701® – 2018

Instructions to Bidders

for the following Project:

(Name, location, and detailed description)

Addition to Thanksgiving Elementary
Thanksgiving Elementary School
1161 Lynch Road
Selma, NC 27576

THE OWNER:

(Name, legal status, address, and other information)

Johnston County Board of Education
601 A West Market Street
Smithfield, NC 27577

THE ARCHITECT:

(Name, legal status, address, and other information)

Hite Associates, P.C.
2600 Meridian Drive
Greenville, NC 27834
Telephone Number: 252-757-0333

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ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Bid, the Bidder represents that:

- .1 the Bidder has read and understands the Bidding Documents;
- .2 the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- .3 the Bid complies with the Bidding Documents;
- .4 the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- .5 the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- .6 the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to bidders.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount

of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:

(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

§ 4.3.2 Paper copies of the Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

§ 4.3.4 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:

(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

§ 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

- .1 a designation of the Work to be performed with the Bidder's own forces;
- .2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and
- .3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.

(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

§ 7.2 Time of Delivery and Form of Bonds

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

- .1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)
- .2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)
- .3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)
- .4 Building Information Modeling Exhibit, if completed:

.5 Drawings

Number	Title	Date
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.6 Specifications

Section	Title	Date	Pages
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.7 Addenda:

Number	Date	Pages
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.8 Other Exhibits:

(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

☐ AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017.)

☐ The Sustainability Plan:

Title	Date	Pages
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☐ Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
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.9 Other documents listed below:

(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

Additions and Deletions Report for

AIA® Document A701® – 2018

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

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Addition to Thanksgiving Elementary
Thanksgiving Elementary School
1161 Lynch Road
Selma, NC 27576

...

Johnston County Board of Education
601 A West Market Street
Smithfield, NC 27577

...

Hite Associates, P.C.
2600 Meridian Drive
Greenville, NC 27834
Telephone Number: 252-757-0333

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 10:16:07 ET on 03/06/2025 under Order No. 4104247004 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A701™ - 2018, Instructions to Bidders, other than those additions and deletions shown in the associated Additions and Deletions Report.

James G. Hite, AIA

(Signed)

Project Architect

(Title)

3/6/2025

(Dated)

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

ARTICLE 3

ADD subparagraph 3.4: In addition to obtaining Bidding Documents from the Hite Associates website, qualified bidders, subcontractors, material suppliers may obtain complete or SpeedyBlue Printers for the cost of printing and mailing partial sets of the Drawings Bidding Documents and specifications from

ADD subparagraph 3.5: All Bidders, subcontractors, and material suppliers are to use the Hite Associates website only, for accurate and complete Bid Documents. The Owner nor the Designers will be responsible for information accessed from any other source.

ARTICLE 4

ADD: Bidders must identify the type of proposal clearly on the Bid Envelope, and include State License number thereon.

ADD: No Bid may be withdrawn after the scheduled closing time for receipt of bids, and shall remain valid and good for 90-days after the bid date.

ARTICLE 7

ADD: Furnish a Performance Bond and a Labor and Material Payment Bond in the amount of the Contract Price, covering faithful performance of contract and payment of all obligations arising thereunder on AIA Document A312.

FORM OF PROPOSAL

From: _____ Contract: GENERAL

Address: _____

To: Johnston County Date: _____

The undersigned, as bidder, hereby declares that the only person or persons interested in this proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this proposal or in the contract to be entered into; that this proposal is made without connection with any other person, company or parties making a bid or proposal; and that it is in all respects fair and in good faith without collusion or fraud.

The bidder further declares that he has examined the site of the work and informed himself fully in regard to all conditions pertaining to the places where the work is to be done, that he has examined the specifications for the work and the contract documents relative thereto, and has read all special provisions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed.

The Bidder proposes and agrees if this proposal is accepted to contract with the County of Johnston, through the **Johnston County Board of Education** in the form of contract specified below, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the construction of the: **Addition to Thanksgiving Elementary School** in full in complete accordance with the plans, specifications and contract documents, to the full and entire satisfaction of the Owner and / or Architect, with a definite understanding that no money will be allowed for extra work except as set forth in the General Conditions and the Contract Documents, for the sum of:

SINGLE PRIME CONTRACT (ALL WORK EXCEPT TECHNOLOGY CONSTRUCTION):

Base Bid:

_____ Dollars(\$)

Plumbing Subcontractor: _____

Electrical Subcontractor: _____

Mechanical Subcontractor: _____

ALTERNATES:

Should any of the alternates as described in the contract documents be accepted, the amount written below shall be the amount to be added to the base bid.

ALTERNATE NO. G-1 Shall be the amount added to the Base Bid to provide door hardware manufacturers as specified in Section 08700, in lieu of other, equivalent manufacturers:

(Add) _____ Dollars(\$)

Alternate No. BCS-1 Shall be the amount added to the Base Bid to provide Schneider Controls (to integrate with existing system), for HVAC controls, controls of equipment platform water heaters, control of water heater circulating cycles, control of exterior lights via photocell provided by EC.

(Add) _____ Dollars(\$)

Alternate No. E-1 Shall be the amount added to the Base Bid to provide Square D electrical equipment in lieu of other, equivalent manufacturers.

(Add) _____ Dollars (\$)

Alternate No. E-2 Shall be the amount added to the Base Bid to provide a fire alarm system manufactured by Notifier Fire Systems (to integrate with existing system) as specified, in lieu of other, equivalent manufacturers.

(Add) _____ Dollars (\$)

UNIT PRICES:

Unit prices quoted and accepted shall apply throughout the life of the contract, except as otherwise specifically noted. Unit prices will include all costs, and shall be applied, as appropriate, to compute the total value of changes in the scope of the installed work, all in accordance with the contract documents. Unit prices listed shall include all overhead and profit costs.

ITEM #	DESCRIPTION	UNIT PRICE
1	Mass Under Cut Excavation (Disposal OFF Site)	c.y. (cubic yard)
2	Foundation Under Cut Excavation (Disposal OFF Site)	c.y. (cubic yard)
3	Off-Site Select Borrow Fill	c.y. (cubic yard)
4	#57 or #67 Stone (Building foundations)	c.y. (square yard)
5	Tensar BX-1100 Geogrid	s.y. (square yard)
6	4" Thick Concrete Sidewalk	s.y. (square yard)
9	Conflict Box	each

NOTE: "Installed" means undercut and fill are measured compacted and in place, not by truckload or prior to compaction.

TIME

The Bidder further proposes and agrees hereby to commence work on a date specified in the Architect's Notice to Proceed, and to complete all work according to the schedule of dates set under Article 8 "Time" of the Supplementary Conditions, WHICH ARE DATES CERTAIN, with no allowance for delays except as may be caused by the Owner. Applicable liquidated damages shall be as stated in the Supplementary General Conditions.

HUB PARTICIPATION REQUIREMENTS:

Provide with the bid - Under GS 143-128.2(c) the undersigned bidder shall identify on its bid (Identification of HUB Participation Form) the HUB businesses that it will use on the project with the total dollar value of the bids that will be performed by the HUB businesses. **Also** list the good faith efforts (Affidavit **A**) made to solicit HUB participation in the bid effort.

NOTE: A contractor that performs all of the work with its own workforce may submit an Affidavit (**B**) to that effect in lieu of Affidavit (**A**) required above. The HUB Participation Form must still be submitted even if there is zero participation.

After the bid opening - The Owner will consider all bids and alternates and determine the lowest responsible, responsive bidder. Upon notification of being the apparent low bidder, the bidder shall then file within 72 hours of the notification of being the apparent lowest bidder, the following:

An Affidavit (**C**) that includes a description of the portion of work to be executed by HUB businesses, expressed as a percentage of the total contract price, which is equal to or more than the 10% goal established. This affidavit shall give rise to the presumption that the bidder has made the required good faith effort and Affidavit **D** is not necessary;

OR

If less than the 10% goal, Affidavit (D) of its good faith effort to meet the goal shall be provided. The document must include evidence of all good faith efforts that were implemented, including any advertisements, solicitations and other specific actions demonstrating recruitment and selection of HUB businesses for participation in the contract.

Note:

Bidders must always submit **with their bid** the Identification of HUB Participation Form listing all HUB contractors, vendors and suppliers that will be used. If there is no HUB participation, then enter none or zero on the form. Affidavit A **or** Affidavit B, as applicable, also must be submitted with the bid. Failure to file a required affidavit or documentation with the bid or after being notified apparent low bidder is grounds for rejection of the bid.

Proposal Signature Page

The undersigned further agrees that in the case of failure on his part to execute the said contract and the bonds within ten (10) consecutive calendar days after being given written notice of the award of contract by the Designer, as agent for the Owner, the certified check, cash or bid bond accompanying this bid shall be paid into the funds of the Owner's account set aside for the project, as liquidated damages for such failure; otherwise the certified check, cash or bid bond accompanying this proposal shall be returned to the undersigned.

Respectfully submitted this day of _____

(Name of firm or corporation making bid)

WITNESS:

By: _____
Signature

(Proprietorship or Partnership)

Name: _____
Print or type

Title _____
(Owner / Partner / President / Vice President)

Address _____

ATTEST:

By: _____

License No. _____

Title: _____
(Corp. Sec. or Asst. Sec. only)

Federal I.D. No. _____

(CORPORATE SEAL)

Addendum received and used in computing bid:

Addendum No. 1 _____ Addendum No. 3 _____ Addendum No. 5 _____ Addendum No. 6 _____

Addendum No. 2 _____ Addendum No. 4 _____ Addendum No. 6 _____ Addendum No. 7 _____

GUIDELINES FOR RECRUITMENT AND SELECTION OF MINORITY BUSINESSES FOR PARTICIPATION IN CONSTRUCTION CONTRACTS

In accordance with G.S. 143-128.2 (effective January 1, 2002) these guidelines establish goals for minority participation in single-prime bidding, separate-prime bidding, construction manager at risk, and alternative contracting methods. The legislation provides that the Public Owner shall have a verifiable ten percent (10%) goal for participation by minority businesses in the total value of work for each project for which a contract or contracts are awarded. These requirements are published to accomplish that end.

SECTION A: INTENT

It is the intent of these guidelines that the Owner, as awarding authority for construction projects, and the contractors and subcontractors performing the construction contracts awarded shall cooperate and in good faith do all things legal, proper and reasonable to achieve the statutory goal of ten percent (10%) for participation by minority businesses in each construction project as mandated by GS 143-128.2. Nothing in these guidelines shall be construed to require contractors or awarding authorities to award contracts or subcontracts to or to make purchases of materials or equipment from minority-business contractors or minority-business subcontractors who do not submit the lowest responsible, responsive bid or bids.

SECTION B: DEFINITIONS

1. Minority - a person who is a citizen or lawful permanent resident of the United States and who is:
 - a. Black, that is, a person having origins in any of the black racial groups in Africa;
 - b. Hispanic, that is, a person of Spanish or Portuguese culture with origins in Mexico, South or Central America, or the Caribbean Islands, regardless of race;
 - c. Asian American, that is, a person having origins in any of the original peoples of the Far East, Southeast Asia and Asia, the Indian subcontinent, the Pacific Islands;
 - d. American Indian, that is, a person having origins in any of the original peoples of North America; or
 - e. Female
2. Minority Business - means a business:
 - a. In which at least fifty-one percent (51%) is owned by one or more minority persons, or in the case of a corporation, in which at least fifty-one percent (51%) of the stock is owned by one or more minority persons or socially and economically disadvantaged individuals; and
 - b. Of which the management and daily business operations are controlled by one or more of the minority persons or socially and economically disadvantaged individuals who own it.
3. Socially and economically disadvantaged individual - means the same as defined in 15 U.S.C. 637. "Socially disadvantaged individuals are those who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as a member of a group without regard to their individual qualities". "Economically disadvantaged individuals are those socially disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to diminished capital and credit opportunities as compared to others in the same business area who are not socially disadvantaged".
4. Public Entity - means the Owner and all public subdivisions and local governmental units.
5. Owner - The public institution named in the contract.

6. Designer – Any person, firm, partnership, or corporation, which has contracted with the Owner to perform architectural or engineering work.
7. Bidder - Any person, firm, partnership, corporation, association, or joint venture seeking to be awarded a public contract or subcontract.
8. Contract - A mutually binding legal relationship or any modification thereof, obligating the seller to furnish equipment, materials or services, including construction, and obligating the buyer to pay for them.
9. Contractor - Any person, firm, partnership, corporation, association, or joint venture which has contracted with the State of North Carolina to perform construction work or repair.
10. Subcontractor - A firm under contract with the prime contractor or construction manager at risk for supplying materials or labor and materials and/or installation. The subcontractor may or may not provide materials in his subcontract.

SECTION C: RESPONSIBILITIES

1. Office for Historically Underutilized Businesses, Department of Administration (hereinafter referred to as HUB Office).

The HUB Office has established a program, which allows interested persons or businesses qualifying as a minority business under G.S. 143-128.2, to obtain certification in the State of North Carolina procurement system. The information provided by the minority businesses will be used by the HUB Office to:

- a. Identify those areas of work for which there are minority businesses, as requested.
- b. Make available to interested parties a list of prospective minority business contractors and subcontractors.
- c. Assist in the determination of technical assistance needed by minority business contractors.

In addition to being responsible for the certification/verification of minority businesses that want to participate in the State construction program, the HUB Office will:

- (1) Maintain a current list of minority businesses. The list shall include the areas of work in which each minority business is interested.
- (2) Inform minority businesses on how to identify and obtain contracting and subcontracting opportunities through the State and other public entities.
- (3) Inform minority businesses of the contracting and subcontracting process for public construction building projects.
- (4) Work with the North Carolina trade and professional organizations to improve the ability of minority businesses to compete in the State construction projects.
- (5) The HUB Office also oversees the minority business program by:
 - a. Monitoring compliance with the program requirements.
 - b. Assisting in the implementation of training and technical assistance programs.
 - c. Identifying and implementing outreach efforts to increase the utilization of minority businesses.
 - d. Reporting the results of minority business utilization to the Secretary of the Department of Administration, the Governor, and the General Assembly.

2. The Owner
The Owner will be responsible for the following:

- a. Reviewing the apparent low bidders' statutory compliance with the requirements listed in the proposal prior to award of contracts. The Owner reserves the right to reject any or all bids and to waive informalities.
 - b. Monitoring of contractors' compliance with minority business requirements in the contract documents during construction.
 - c. Providing statistical data and required reports to the HUB Office.
 - d. Resolving any protest and disputes arising after implementation of the plan.
3. Constituent Institutions of The State of North Carolina
Before awarding a contract, a constituent institution shall do the following:
- a. Implement the constituent institution HUB plan.
 - b. Attend the scheduled prebid conference.
 - c. At least 10 days prior to the scheduled day of bid opening, notify minority businesses that have requested notices from the public entity for public construction or repair work and minority businesses that otherwise indicated to the Office for Historically Underutilized Businesses an interest in the type of work being bid or the potential contracting opportunities listed in the proposal. The notification shall include the following:
 1. A description of the work for which the bid is being solicited.
 2. The date, time, and location where bids are to be submitted.
 3. The name of the individual within the owner's organization who will be available to answer questions about the project.
 4. Where bid documents may be reviewed.
 5. Any special requirements that may exist.
 - d. Utilize other media, as appropriate, likely to inform potential minority businesses of the bid being sought.
 - e. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
 - f. Review, jointly with the designer, all requirements of G.S. 143-128.2(c) and G.S. 143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with corresponding total dollar value of the bid and affidavit listing good faith efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award.
 - g. Evaluate documentation to determine good faith effort has been achieved for minority business utilization prior to recommendation of award.
 - h. Review prime contractors' pay applications for compliance with minority business utilization commitments prior to payment.
 - i. Document evidence of implementation of Owner's responsibilities.
4. Designer
Under the single-prime bidding, separate prime bidding, construction manager at risk, or alternative contracting method, the designer will:
- a. Attend the scheduled prebid conference to explain minority business requirements to the prospective bidders.
 - b. Assist the owner to identify and notify prospective minority business prime and subcontractors of potential contracting opportunities.
 - c. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
 - d. Review jointly with the owner, all requirements of G.S. 143-128.2(c) and G.S.143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with corresponding total dollar value of the bid and affidavit listing Good Faith Efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award.

- e. During construction phase of the project, review “MBE Documentation for Contract Payment” – (Appendix E) for compliance with minority business utilization commitments. Submit Appendix E form with monthly pay applications to the owner and forward copies to the Owner.
 - f. Make documentation showing evidence of implementation of Designer’s responsibilities available for review by the Owner and HUB Office, upon request.
5. Prime Contractor(s), CM at Risk, and Its First-Tier Subcontractors
Under the single-prime bidding, the separate-prime bidding, construction manager at risk and alternative contracting methods, contractor(s) will:
- a. Attend the scheduled prebid conference.
 - b. Identify or determine those work areas of a subcontract where minority businesses may have an interest in performing subcontract work.
 - c. At least ten (10) days prior to the scheduled day of bid opening, notify minority businesses of potential subcontracting opportunities listed in the proposal. The notification will include the following:
 - (1) A description of the work for which the subbid is being solicited.
 - (2) The date, time and location where subbids are to be submitted.
 - (3) The name of the individual within the company who will be available to answer questions about the project.
 - (4) Where bid documents may be reviewed.
 - (5) Any special requirements that may exist, such as insurance, licenses, bonds and financial arrangements.

If there are more than three (3) minority businesses in the general locality of the project who offer similar contracting or subcontracting services in the specific trade, the contractor(s) shall notify three (3), but may contact more, if the contractor(s) so desires.
 - d. During the bidding process, comply with the contractor(s) requirements listed in the proposal for minority participation.
 - e. Identify on the bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit listing good faith efforts as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).
 - f. Make documentation showing evidence of implementation of PM, CM-at-Risk and First-Tier Subcontractor responsibilities available for review by the constituent institution and HUB Office, upon request.
 - g. Upon being named the apparent low bidder, the Bidder shall provide one of the following: (1) an affidavit (Affidavit C) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal; (2) if the percentage is not equal to the applicable goal, then documentation of all good faith efforts taken to meet the goal. Failure to comply with these requirements is grounds for rejection of the bid and award to the next lowest responsible and responsive bidder.
 - h. The contractor(s) shall identify the name(s) of minority business subcontractor(s) and corresponding dollar amount of work on the schedule of values. The schedule of values shall be provided as required in Article 31 of the General Conditions of the Contract to facilitate payments to the subcontractors.
 - i. The contractor(s) shall submit with each monthly pay request(s) and final payment(s), “MBE Documentation for Contract Payment” – (Appendix E), for designer’s review.
 - j. During the construction of a project, at any time, if it becomes necessary to replace a minority business subcontractor, immediately advise the Owner, and the Director of the HUB Office in writing, of the circumstances involved. The prime contractor shall make a good faith effort to replace a minority business subcontractor with another minority business subcontractor.
 - k. If during the construction of a project additional subcontracting opportunities become available, make a good faith effort to solicit subbids from minority businesses.
 - l. It is the intent of these requirements apply to all contractors performing as prime contractor and first tier subcontractor under construction manager at risk on state projects.

6. Minority Business Responsibilities

While minority businesses are not required to become certified in order to participate in the State construction projects, it is recommended that they become certified and should take advantage of the appropriate technical assistance that is made available. In addition, minority businesses who are contacted by owners or bidders must respond promptly whether or not they wish to submit a bid.

SECTION D: DISPUTE PROCEDURES

It is the policy of this state that disputes that involves a person's rights, duties or privileges, should be settled through informal procedures. To that end, minority business disputes arising under these guidelines should be resolved as governed under G.S. 143-128(g).

SECTION E: These guidelines shall apply upon promulgation on University construction projects. Copies of these guidelines may be obtained from:

<http://www.NorthCarolina.edu/finance/projects/projects.cfm#attachments>

SECTION F: In addition to these guidelines, there will be issued with each construction bid package provisions for contractual compliance providing MBE participation in State building projects. An explanation of the process follows, titled “MINORITY BUSINESS CONTRACT PROVISIONS (CONSTRUCTION)” along with relevant forms for its implementation (“Identification of Minority Business Participation” form, Affidavits A, B, C, D and Appendix E).

MINORITY BUSINESS CONTRACT PROVISIONS (CONSTRUCTION)

APPLICATION:

The **Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts** are hereby made a part of these contract documents. These guidelines shall apply to all contractors regardless of ownership. Copies of these guidelines may be obtained from: <http://www.NorthCarolina.edu/finance/projects/projects.cfm#attachments>

MINORITY BUSINESS SUBCONTRACT GOALS:

The goals for participation by minority firms as subcontractors on this project have been set at 10%.

The bidder must identify on its bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit (Affidavit A) listing good faith efforts **or** affidavit (Affidavit B) of self-performance of work, if the bidder will perform work under contract by its own workforce, as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).

The lowest responsible, responsive bidder must provide Affidavit C, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal.

OR

Provide Affidavit C, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, **with documentation of Good Faith Effort, if the percentage is not equal to the applicable goal.**

OR

Provide Affidavit B, which includes sufficient information for the State to determine that the bidder does not customarily subcontract work on this type project.

The above information must be provided as required. Failure to submit these documents is grounds for rejection of the bid.

MINIMUM COMPLIANCE REQUIREMENTS:

All written statements, affidavits or intentions made by the Bidder shall become a part of the agreement between the Contractor and the Owner for performance of this contract. Failure to comply with any of these statements, affidavits, or intentions, or with the minority business Guidelines shall constitute a breach of the contract. A finding by the Owner that any information submitted either prior to award of the contract or during the performance of the contract is inaccurate, false or incomplete, shall also constitute a breach of the contract. Any such breach may result in termination of the contract in accordance with the termination provisions contained in the contract. It shall be solely at the option of the Owner whether to terminate the contract for breach.

In determining whether a contractor has made Good Faith Efforts, the Owner will evaluate all efforts made by the Contractor and will determine compliance in regard to quantity, intensity, and results of these efforts. Good Faith Efforts include:

- (1) Contacting minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor or available on State or local government maintained lists at least 10 days before the bid or proposal date and notifying them of the nature and scope of the work to be performed.
- (2) Making the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bid or proposals are due.
- (3) Breaking down or combining elements of work into economically feasible units to facilitate minority participation.
- (4) Working with minority trade, community, or contractor organizations identified by the Office for Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- (5) Attending any prebid meetings scheduled by the public owner.
- (6) Providing assistance in getting required bonding or insurance or providing alternatives to bonding or insurance for subcontractors.
- (7) Negotiating in good faith with interested minority businesses and not rejecting them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- (8) Providing assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisting minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- (9) Negotiating joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- (10) Providing quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

do hereby certify that on this project we will use the following minority business enterprises as construction subcontractors, vendors, suppliers or providers of professional services.

*Minority categories: Black, African American (B), Hispanic (H), Asian American (A) American Indian (I), Female (F) Socially and Economically Disadvantaged (D)

- - 8 - -

AFFIDAVIT A – Listing of the Good Faith Effort

County of _____

Affidavit of _____
(Bidder)

I have made a good faith effort to comply under the following areas checked:

(A minimum of 5 areas must be checked in order to have achieved a "good faith effort")

- ☐ 1 - Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- ☐ 2 - Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.
- ☐ 3 - Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- ☐ 4 - Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- ☐ 5 - Attended prebid meetings scheduled by the public owner.
- ☐ 6 - Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- ☐ 7 - Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- ☐ 8 - Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers, in order to help minority businesses in establishing credit.
- ☐ 9 - Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- ☐ 10 - Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

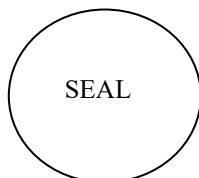
In accordance with GS143-128.2(d) the undersigned will enter into a formal agreement with the firms Listed, in the Identification of Minority Business Participation schedule conditional upon execution of a contract with the Owner. Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____



State of North Carolina, County of _____

Subscribed and sworn to before me this _____ day of _____ 20

Notary Public _____

My commission expires _____

AFFIDAVIT B – Intent to Perform Contract with Own Workforce.

County of _____

Affidavit of _____

(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for
the _____ contract.

(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

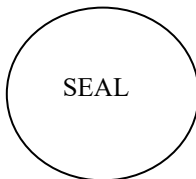
The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: _____ Name of Authorized Officer _____

Signature: _____

Title: _____



State of North Carolina, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public _____

My commission expires _____

AFFIDAVIT C - Portion of the Work to be Performed by Minority Firms

Project _____

***** (NOTE: THIS FORM IS NOT TO BE SUBMITTED WITH THE BID PROPOSAL) *****

If the portion of the work to be executed by minority businesses as defined in GS143-128.2(g) is equal to or greater than 10% of the bidders total contract price, then the bidder must complete this affidavit. This affidavit shall be provided by the apparent lowest responsible, responsive bidder within 72 hours after notification of being low bidder.

Affidavit of: _____ I do hereby certify that on the
(Bidder)

(Project Name)

Amount of Bid \$ _____

I will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises. Minority Businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below.

Attach additional sheets if required.

Name and Phone Number	*Minority Category	Work description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

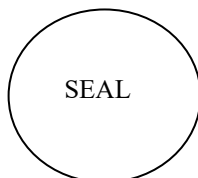
Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____



State of North Carolina, County of _____
Subscribed and sworn to before me this _____ day of _____ 20____
Notary Public _____
My commission expires _____

AFFIDAVIT D – Good Faith Efforts

Project _____

If the goal of 10% participation by minority business **is not** achieved, the Bidder shall provide the following documentation to the Owner of his good faith efforts

(Bidder

Affidavit of: _____)

I do certify the attached documentation as true and accurate representation of my good faith efforts.

(Attach additional sheets if required)

Name and Phone Number	*Minority Category	Work description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

Documentation of the Bidder's good faith efforts to meet the goals set forth in these provisions.

Examples of documentation shall include the following evidence:

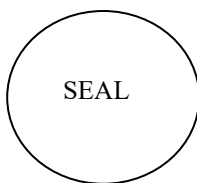
- A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.
- B. Copies of quotes or responses received from each firm responding to the solicitation.
- C. A telephone log of follow-up calls to each firm sent a solicitation.
- D. For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.
- E. Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.
- F. Copy of pre-bid roster.
- G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.
- H. Letter detailing reasons for rejection of minority business due to lack of qualification.
- I. Letter documenting proposed assistance offered to minority businesses in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the next lowest responsible and responsive bidder.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____



State of North Carolina, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public _____

My commission expires _____

APPENDIX E

MBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: _____

Address & Phone: _____

Project Name: _____

Pay Application #: _____ Period: _____

The following is a list of payments to be made to minority business contractors on this project for the above-mentioned period.

Firm Name	*Minority Category	Payment Amount (List invoice number and amount)	Owner Use Only

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

Date: _____ Approved/Certified By: _____

Name

Title

Signature

****THIS DOCUMENT MUST BE SUBMITTED WITH EACH PAY REQUEST & FINAL PAYMENT****

Standard Form of Agreement Between Owner and Contractor

*where the basis of payment is a
STIPULATED SUM*

AGREEMENT made as of the « » day of « » in the year «2025 »
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

«Johnston County Board of Education»
«2320 US 70 Business East
Smithfield, NC 27577
« »

and the Contractor:
(Name, legal status, address and other information)

«xyz »«CONTRACTOR »
« »
« »
« »

for the following Project:
(Name, location and detailed description)

«Addition to THANKSGIVING Elementary School
«1161 Lynch Road
Selma, NC 27576

The Architect:
(Name, legal status, address and other information)

«Hite Associates, PC »« »
«2600 Meridian Drive »
«Greenville, NC 27834 »
« »

The Owner and Contractor agree as follows.

TABLE OF ARTICLES

1	THE CONTRACT DOCUMENTS
2	THE WORK OF THIS CONTRACT
3	DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
4	CONTRACT SUM
5	PAYMENTS
6	DISPUTE RESOLUTION
7	TERMINATION OR SUSPENSION
8	MISCELLANEOUS PROVISIONS
9	ENUMERATION OF CONTRACT DOCUMENTS
10	INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

“Each Prime Contractor shall execute the entire Work described in the Contract Documents and reasonably inferable from them as being necessary to produce the intended results. In general, the Work includes but is not limited to the furnishing of all labor, materials, equipment, tools, services and supervision to perform the Work for the project”.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.

(Insert the date of commencement if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

Seven days from receipt of Notice to Proceed.

If, prior to the commencement of the Work, the Owner requires time to file mortgages and other security interests, the Owner’s time requirement shall be as follows:

« »

§ 3.2 The Contract Time shall be measured from the date of commencement.

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than « » (« ») days from the date of commencement, or as follows:
(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)

In accordance with the schedule of COMPLETION DATES set forth in the Supplementary Conditions, under Article 8, "Time", all of which are DATES CERTAIN, with no delays allowed except as caused by the Owner.

« »

Portion of Work	Substantial Completion Date
-----------------	-----------------------------

, subject to adjustments of this Contract Time as provided in the Contract Documents.
(Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)

«
Substantial Completion liquidated damages- \$1000 per day.

Final Completion liquidated damages - \$1000 per day.

See Section 9.11 of the General and Article 8 of Supplemental Conditions for additional provisions regarding liquidated damages.
»

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be « » (\$ « »), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

« »

§ 4.3 Unit prices, if any: See Form of Proposal
(Identify and state the unit price; state quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price Per Unit (\$0.00)
------	-----------------------	-------------------------

§ 4.4 Allowances included in the Contract Sum, if any: See Form of Proposal
(Identify allowance and state exclusions, if any, from the allowance price.)

Item	Price

ARTICLE 5 PAYMENTS

§ 5.1 PROGRESS PAYMENTS

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

« One calendar month ending on the twenty-fifth day of the month. »

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the « » day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the « » day of the « » month. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than « » (« ») days after the Architect receives the Application for Payment. *(Federal, state or local laws may require payment within a certain period of time.)*

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

- .1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage as outlined in Section 9.3.1.3 of the General and Supplemental Conditions . Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.9 of AIA Document A201™–2007, General Conditions of the Contract for Construction, as amended;
- .2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage as outlined in Section 9.3.1.3 of the General and Supplemental Conditions;
- .3 Subtract the aggregate of previous payments made by the Owner; and
- .4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201–2007, as amended.

§ 5.1.7 The progress payment amount determined in accordance with Section 5.1.6 shall be further modified under the following circumstances:

- .1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and
(Section 9.8.5 of AIA Document A201–2007 requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)

- .2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201–2007, as amended.

§ 5.1.8 Reduction or limitation of retainage, if any, shall be as follows:

(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.6.1 and 5.1.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)

«

See Section 9.3 of the General and Supplemental Conditions.

»

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 FINAL PAYMENT

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2.2 of AIA Document A201–2007, as amended, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

« »

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 INITIAL DECISION MAKER

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201–2007, as amended, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.

(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

« The Architect shall be the Initial Decision Maker as outlined in Article 15 of the General and Supplemental Conditions.

§ 6.2 BINDING DISPUTE RESOLUTION

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A201–2007, as amended, the method of binding dispute resolution shall be as follows:

(Check the appropriate box. If the Owner and Contractor do not select a method of binding dispute resolution below, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.)

[☒] Johnston County Superior Court

« »

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2007, as amended.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2007, as amended.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007, as amended or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 Payments due and unpaid under the Contract shall not bear interest.

(Insert rate of interest agreed upon, if any.)

« Zero » % « 0% »

§ 8.3 The Owner's representative:

(Name, address and other information)

« »
« »
« »
« »
« »
« »

§ 8.4 The Contractor's representative:

(Name, address and other information)

« »
« »
« »
« »
« »
« »

§ 8.5 Neither the Owner's nor the Contractor's representative shall be changed without ten days written notice to the other party.

§ 8.6 Other provisions:

« »

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is this executed AIA Document A101–2007, Standard Form of Agreement Between Owner and Contractor.

§ 9.1.2 The General Conditions are AIA Document A201–2007, General Conditions of the Contract for Construction, as amended. The amended version of AIA Document A201-2007 is included in the Project Manual.

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
Section 01010	General Conditions	XXXX	XXXX
Section 01012	Supplementary General Conditions	XXXX	XXXX
Section 01040	General Requirements	XXXX	XXXX

§ 9.1.4 The Specifications:

(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

«See Exhibit A »

Section	Title	Date	Pages

§ 9.1.5 The Drawings:

(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

«See Exhibit B »

Number	Title	Date

§ 9.1.6 The Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are also enumerated in this Article 9.

§ 9.1.7 Additional documents, if any, forming part of the Contract Documents:

- .1 AIA Document E201™–2007, Digital Data Protocol Exhibit, if completed by the parties, or the following:

« »

- .2 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201–2007 provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor’s bid are not part of the Contract Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

«FORM OF PROPOSAL »

ARTICLE 10 INSURANCE AND BONDS

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201–2007, as amended.

--	--

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

Johnston County Board of Education
2320 US 70 Business East
Smithfield, NC 27577

OWNER *(Signature)*

« »«Board Chairperson »
(Printed name and title)

Attest

CONTRACTOR *(Signature)*

« »«President »
(Printed name and title)

Attest

Superintendent

[Corporate Seal]

Corporate Secretary

[Corporate Seal]

This instrument has been preaudited
in the manner required by the School
Budget and Fiscal Control Act.

Finance Officer/Date

for the following PROJECT:

(Name and location or address)

Addition to Thanksgiving Elementary School
1161 Lynch Road,
Selma, NC 27576
Johnston County, North Carolina

THE OWNER:

(Name and address)

Johnston County Board of Education
2320 US 70 Business East
Smithfield, NC 27577

THE ARCHITECT:

(Name and address)

Hite Associates, PC
2600 Meridian Drive
Greenville, NC 27834

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both 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 Architect.

§ 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor except to the extent that these Contract Documents, or portions of these Contract Documents, have been incorporated into the Agreement(s) between the Owner and the Architect. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 THE 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.

§ 1.1.4 THE 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 and by separate contractors.

§ 1.1.5 THE DRAWINGS

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

§ 1.1.5.1 Dimensions indicated on the Drawings shall be followed. Do not scale drawings. Conflicts, discrepancies, and omissions shall be resolved prior to ordering or installing materials and equipment.

§ 1.1.5.2 The Contractor shall provide critical clearances, tolerances, and dimensions as indicated on the Drawings. These critical dimensions are not optional. The Architect shall be advised immediately if existing conditions do not permit critical dimensions as shown. No consideration will be given to any claim based on differences between the actual dimensions and those indicated on the drawings.

§ 1.1.5.3 Any modifications to the Drawings shall be approved by the Architect. The Architect's decision in matters relating to artistic effect and structural integrity will be final if consistent with the intent of the Contract Documents.

§ 1.1.5.4 The Drawings are developed to communicate design intent. Assemblies or components required to achieve this design intent are subject to approval by the Architect.

§ 1.1.6 THE SPECIFICATIONS

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

§ 1.1.7 INSTRUMENTS OF SERVICE

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

§ 1.2.1 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; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and with terms reasonably inferable from them, though not expressly included in them, as being necessary to produce the indicated results.

§ 1.2.2 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 trade.

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

§ 1.3 CAPITALIZATION

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 INTERPRETATION AND EXECUTION OF THE CONTRACT DOCUMENTS

§ 1.4.1 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. These Contract Documents periodically refer to 2007 Editions of AIA Documents A201 and/or B101. In the interest of brevity, the Contract Documents may not always specify that each such reference is to AIA Documents A201 and/or B101 only as modified and amended by the Owner. Nonetheless, each reference to AIA Documents A201 and/or B101 is only to those documents as modified and amended by the Owner.

§ 1.4.2 The Contract Documents shall be signed by the Owner and Contractor in the places designated for their signatures. If either the Owner or Contractor or both do not sign all Contract Documents, the Architect shall identify such unsigned Documents and notify the Owner and Contractor.

§ 1.4.3 In the Contract Documents, where discrepancies are apparent, detailed information is lacking, or interpretation is not clear, the Contractor shall secure required information from the Architect in writing before proceeding with the work. Items that are detailed and/or specified, but not distinctly located on the drawings shall be located by the Architect upon the written request of the Contractor.

§ 1.5

OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and joint owners with the Owner of their respective Instruments of Service, including the Drawings and Specifications, and will retain, with the Owner, all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. 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 Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall do so as provided in the Agreement or the Contract Documents.

ARTICLE 2 OWNER

§ 2.1 GENERAL

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner may designate in its written policies or otherwise in writing a representative who may have express authority to bind the Owner with respect to identified matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or, where specifically authorized in writing, the Owner's authorized representative.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence within fifteen (15) days after its receipt of a request demonstrating the existence of one or more of the contractual bases for the request.

§ 2.2.2 Payment for permits and fees is the responsibility of the Contractor under the Contract Documents, including the payment of fees specified under Section 3.7.1. The Owner shall only pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities about which the Contractor notified the Owner in writing in advance of the execution of this Agreement..

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and any known utility locations for the site of the Project, and a legal description of the site. The information shown on the Drawings is based upon field surveys, plans from previous construction projects, and other

information provided by the Owner. It is the Contractor's responsibility to verify locations of items that may impact the construction of the work. The Contractor shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish other relevant information or services under the Owner's exclusive control, not also under the Architect's and/or Contractor's control, after the Contractor demonstrates to the Owner's satisfaction in writing that such other information or service under the Owner's exclusive control is necessary to the Contractor's performance of the Work and provides the Owner with a written request for such information or service. .

§ 2.2.4.1 The Owner shall not be responsible or have control over or charge of the construction means, methods, techniques, sequences, or procedures or for safety precautions and programs in connection with the work, and the Owner will not be responsible for the Contractor's failure to carry out the Work in accordance with the contract documents.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2. Additional sets will be furnished at the cost of reproduction, postage and handling.

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.4 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 ten-day period after service of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, 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 reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor or surety shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 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 Owner or the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Specifications, Drawings and other Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents. The Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.2.1 The Contractor shall verify all grades, lines, levels and dimensions indicated or shown on the plans and specifications prior to beginning the Work and shall immediately report in writing any errors or inconsistencies to the Architect before commencing the Work.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations and makes the reports required in Sections 3.2.2 and 3.2.3, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 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 the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below in this section, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or

procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Architect shall be solely responsible for any loss or damage arising solely from those Architect-required means, methods, techniques, sequences or procedures.

§ 3.3.2 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 or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be solely responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.3.4 The general contractor shall be the project expediter for the project. In addition to the duties and responsibilities stated in this Agreement, the general contractor/project expediter shall perform the duties and obligations imposed on the general contractor and project expediter by State law.

§ 3.4 LABOR AND MATERIALS

§ 3.4.1 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.

§ 3.4.1.1 The Contractor shall use only new materials for the work of this Project. Reuse of existing materials or the use of other salvaged materials is acceptable only where specifically noted in the Construction Documents.

§ 3.4.1.2 The Contractor shall provide all special trims, moldings, and special shaped materials which are required for the satisfactory completion of the work. The Contractor shall provide all necessary fasteners, bracing, and supports required for the stable and secure installation of the Work.

§ 3.4.2 The Contractor may make substitutions only with the written consent of the Owner, after evaluation and approval by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.4.4 After the contract has been executed, the Owner and the Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the Contract Documents.

§ 3.4.5 By making request for substitutions based on subparagraphs 3.4.3 above, the Contractor: (1) represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified; (2) represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified; (3) certifies that the cost data presented is complete and includes all related costs under this contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently

become apparent; and (4) will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.

§ 3.4.6 The Contractor shall provide the Owner at least two copies of all manufacturer's literature and operating manuals for all equipment and materials installed on the Project. The Contractor shall also demonstrate operation and maintenance of all mechanical and electrical equipment or apparatus installed as part of the contract.

§ 3.4.7. Contractor shall comply with all applicable laws and regulations in providing services under this Agreement. Contractor represents that it is aware of and in compliance with the Immigration Reform and Control Act, and that it will collect properly verified I-9 forms from each employee providing services under this Agreement. Contractor shall not employ any individuals to provide services to the Owner who are not authorized by federal law to work in the United States.

§ 3.5 WARRANTY

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements, including substitutions not properly approved or authorized by the Owner, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by the Owner's abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 TAXES

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

§ 3.6.2 The Contractor shall provide documentation of all sales tax paid in a format acceptable to the Owner with each pay application.

§ 3.7 PERMITS, FEES, NOTICES, AND COMPLIANCE WITH LAWS

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections performed or required by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.2.1 While the Contractor is not responsible for ensuring that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules, regulations, and lawful orders of public authorities, if the Contractor observes that portions of the Contract Documents are at variance with applicable laws, statutes, ordinances, codes, rules, regulations, or lawful orders of public authorities, the

Contractor shall promptly notify the Architect and Owner in writing, and the Architect shall make necessary changes through an appropriate modification.

§ 3.7.3 If the Contractor performs Work that it knew or should have known to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that 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, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than ten (10) days after first observance of the conditions. The Architect 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 Architect 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 Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If the Contractor disputes the Architect's determination or recommendation, the Contractor may proceed as provided in Article 15, giving the required notice of his/her dispute and stating a claim in writing to the Owner and the Architect within 21 days after the Architect has given notice of its decision. . The Contractor's failure to submit said claim in strict conformance with Article 15 shall be deemed a waiver of the claim and the Contractor shall not be entitled to any compensation associated with the claim.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Architect shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Architect but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15. The Contractor's failure to submit said claim in strict conformance with Article 15 shall be deemed a waiver of the claim and the Contractor shall not be entitled to any compensation associated with the claim.

§ 3.8 ALLOWANCES

§ 3.8.1 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 to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2** 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 but not in the allowances; and

- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.8.4 In any situations in which the Contractor has provided a unit price for an allowance quantity for soil, rock or any other item identified in the bid documents, the unit price shall include all of the costs identified in Section 3.8.2.1. and the costs for unloading and handling at the site, installation, overhead, profit and other expenses associated with the item. If the quantity of the items included in the allowance is not used or exceeded during the Project, the Contract Sum shall be decreased or increased based upon the unit price amount by Change Order.

§ 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ a competent superintendent, site foreman and necessary assistants who shall be in attendance at the Project site at all times 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.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract but not more than 14 days after the award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of the proposed project manager and superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed project manager or superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection. Notwithstanding the above, the Owner and Architect reserve the right to notify the Contractor of their reasonable objection to the project manager and/or superintendent after the 14-day period based upon their performance or failure to perform their duties and responsibilities.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection and shall promptly replace a project manager and/or superintendent subsequently objected to by the Owner and Architect pursuant to Section 3.9.2.. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information and use and for the Owner's and Architect's approval as to the completion date a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under 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 coordinated, expeditious and practicable execution of the Work and Project in cooperation with the other prime contractors on the Project. In the event the Project has been awarded as a multi-prime project, each of the prime contractors shall provide initial and updated schedule information to the Project Expediter as often and in any format reasonably requested by the Project Expediter.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for

the Architect's approval. The Architect's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.10.4 The general contractor shall be the project expeditor for the Project. In addition to the duties and obligations stated in this Agreement, the general contractor/project expeditor shall perform all duties and obligations imposed on the general contractor and project expeditor by state law. It shall be the responsibility of the general contractor to integrate the construction schedules of the prime contractors into a project progress schedule that will show graphically, by a detailed bar chart, CPM, or other acceptable and approved methods, the projected progress of the Project from start to finish. The general contractor shall be responsible for providing adequate notice to all prime contractors to insure efficient continuity of all phases of the Project Work. All prime contractors shall review and conform their work to the approved progress schedule and fully inform the Project Expediter as to his work progress, including immediate notification of any work progress changes. The general contractor shall promptly notify Architect in writing of any Contractor's failure to progress the work in accordance with the schedule.

§ 3.10.5 All prime contractors shall be required to cooperate and consult with each other during the construction of this Project. Each prime contractor shall schedule and execute his work so as to cause no delay to other Contractors. Each prime contractor shall be financially responsible to the other prime contractors for delay caused by him to the other prime contractors on the Project.

§ 3.10.6 Each prime contractor is required to attend monthly job site progress conference called or scheduled by the Architect. Each prime contractor shall be represented at these job progress conferences by both home office and site personnel. These meetings shall be open to the subcontractors, materials suppliers, any others who can contribute toward maintaining required job progress. It shall be the principal purpose of these meetings, or conferences, to effect coordination, cooperation, and assistance in every practical way toward the end of maintaining progress the project on schedule and to complete the Project within the specified contract time. Each prime contractor shall be prepared to assess progress of the work as required in his particular contract and to recommend remedial measures for correction of progress as may be appropriate. The Architect or his representative shall be the coordinator of and preside over the conferences.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for inclusion in the submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

§ 3.12.1 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.

§ 3.12.2 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.

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

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, 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.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

§ 3.12.9 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 Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or

equipment are specifically required of the Contractor by the Contract Documents, the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents, but shall provide written notification to the Owner and Architect regarding any concerns or objections the Contractor may have regarding the design criteria.

§ 3.13 USE OF SITE

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, permits, the Contract Documents, and as allowed by the Owner and Architect and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 CUTTING AND PATCHING

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 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.

§ 3.14.3 All patching shall be performed by mechanics of the trades dictated by the materials used in the patching operations.

§ 3.15 CLEANING UP

§ 3.15.1 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 waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

§ 3.15.3 The general construction contractor shall leave the completed work in conditions for occupancy by the Owner such that no cleaning, waxing, polishing, or other janitorial operations are required.

§ 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

§ 3.18 INDEMNIFICATION

§ 3.18.1 The Contractor shall indemnify and hold harmless the Owner, Architect, and their agents and consultants, for damages, losses, or claims, including attorneys' fees and costs incurred in the defense of such claims, that arise solely from the negligent acts, errors and/or omissions, or failures to perform, by the Contractor, its employees, agents, or consultants. The parties agree that this indemnification clause is an "evidence of indebtedness" for purpose of N.C. Gen. Stat. § 6-21.2. The parties also specifically acknowledge that the Owner is a public body and it is the intent of the parties that the Owner not incur any expenses when the Contractor is solely responsible for the claims.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 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 Section 3.18.1 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.

§ 3.19 CONTRACTOR'S REPRESENTATIONS

§ 3.19.1 By entering into this contract with the Owner, the Contractor represents and warrants the following, together with all other representations and warranties in the Contract Documents:

.1 that he is experienced in and competent to perform the type of work required and to furnish the materials, supplies or equipment to be so performed or furnished by him;

.2 that he is financially solvent, able to pay his debts as they mature, and possessed of sufficient working capital to initiate and complete the work required under the contract;

.3 that he is familiar with all federal, state, county, and local laws, ordinances, permits, regulations, and resolutions which may in any way affect the work or those employed therein, including but not limited to any special laws or regulations relating to the work or any part thereof;

.4 that such temporary and permanent work required by the Contract Documents which is to be done by him will be satisfactorily constructed and fit for use for its intended purpose and that such construction will not injure any person, or damage any property;

.5 that he has carefully examined the Contract Documents and the site of the work and that from his own investigations, he has satisfied himself and made himself familiar with: (1) the nature and location of the work; (2) the character, quality, and quantity of surface and subsurface materials likely to be encountered, including but not limited to, all structures and obstructions on or at the project site, both natural and man-made; (3) the character of equipment and other facilities needed for the performance of the work; (4) the general and local conditions including without limitation its climatic conditions, the availability and cost of labor and the availability and cost of materials, tools, equipment, labor, and professional services necessary to complete the work in the manner required by the Contract Documents; and (6) all other matters or things which could in any manner affect the performance of the work;

- .6 that he will fully comply with all requirements of the Contract Documents;
- .7 that he will perform the work consistent with good workmanship, sound business practice, and in the most expeditious manner consistent with the best interests of the Owner;
- .8 that he will furnish efficient business administration and experienced superintendence and an adequate supply of workmen/women, equipment, tools, and materials at all times;
- .9 that he has carefully reviewed the work required and that the work can be planned and executed in a normal and orderly sequence of work and reasonably scheduled so as to ensure completion of the project in accordance with the Contract Documents, allowing for normal and reasonably foreseeable weather, labor and other delays, interruptions and disruptions of the work;
- .10 that he will complete the work within the contract time and all portions thereof within any required contract deadlines;
- .11 that his contract price is based upon the labor, materials, systems and equipment required by the contract documents, without exception;
- .12 that he will make a good faith effort to utilize minority business enterprises (MBEs) per N.C. Gen. Stat. § 143-128, et seq., and the Owner's policy, as subcontractors for the work; and
- .13 that he and all others acting on his behalf and/or pursuant to a contract with the him have obtained and shall retain throughout the duration of this Agreement all required licenses and certifications required in order to perform the work identified in the Contract Documents, that he will not permit any such licenses or certifications to lapse at any time during the course of his work on this Project, and that he and all others acting on his behalf and/or pursuant to a contract with him are fully licensed and certified to perform all work required by the Contract Documents and this Agreement.

ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

§ 4.1.1 The Architect shall be lawfully licensed to practice architecture or shall be an entity lawfully practicing architecture in the jurisdiction where the Project is located. That lawfully-licensed person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner and Architect and notice, in advance, to the Contractor. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall in its sole discretion employ a successor architect whose status under the Contract Documents shall be that of the Architect.

§ 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate For Payment. The Architect will also be the Owner's representative from time to time during the period for correction of Work. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with the other provisions of the Contract.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect and Owner will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety

precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect will not be responsible to the Contractor for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect 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 any other persons or entities performing portions of the Work.

§ 4.2.4 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 with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Architect.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect 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 Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect 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 Architect's action will be taken in accordance with an appropriate submittal schedule approved by the Architect such that the Architect's action will be taken with such reasonable promptness as to cause no delay in the Work or activities of the Owner, Contractor, or separate contractors, while allowing sufficient time in the Architect's professional judgment to permit adequate review, or, in the absence of an approved submittal schedule, with reasonable promptness as to cause no delay in the Work or activities of the Owner, Contractor, or separate contractors while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of 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 Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions, including as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion when in the Architect's professional opinion the Work or portion of Work is substantially complete and the date of final completion when in the Architect's professional opinion the Work or portion of the Work is finally complete; issue Certificates of Substantial Completion pursuant to Section 9.8; 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 pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10 and upon compliance with all other requirements of the Contract Documents.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon in writing or otherwise with reasonable promptness as to cause no delay in the Work or activities of the Owner, Contractor, or separate contractors, while allowing sufficient time in the Architect's professional judgment to permit adequate review.

§ 4.2.12 Interpretations and decisions of the Architect 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 Architect will endeavor to secure faithful performance by the Owner, Contractor and any prime contractors will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

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

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon in writing or otherwise with reasonable promptness as to cause no delay in the Work or activities of the Owner, Contractor, or separate contractors, while allowing sufficient time in the Architect's professional judgment to permit adequate review. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

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 Architect 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. The Architect shall reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection by the Architect.

§ 5.2.1.1 Notwithstanding Section 5.2.1, the Contractor shall identify in the list of names of the subcontractors proposed, those subcontractors that are minority business enterprises and the date each is planned to begin work on the Project. This list of subcontractors and materials suppliers shall be submitted to the Architect not later than 10 calendar days after the date the Contractor executes the Contract. The Contractor shall not use a different Contractor to perform the work of any subcontractor identified pursuant to this section without providing written notice to the Owner and Architect regarding the reason for the change and only after complying with any requirements in G.S. 143-128.2 to 128.4.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.2.5 If during the duration of the Project the Contractor effects a substitution for any subcontractor per subparagraph 5.2, or if additional subcontract opportunities become available, the Contractor shall make a good faith effort to utilize minority business enterprises. The Contractor shall provide written notification of all new subcontractors.

§ 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 of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect 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 that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and future obligations under the subcontract, but the Owner does not assume liability for obligations incurred by the Contractor prior to assignment of the subcontract.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall not be legally responsible for any of the successor contractor's obligations under the subcontract.

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 under Conditions of the Contract identical or substantially similar to these. Failure by the Contractor to make a claim in any way associated with the Owner's right to perform construction and to award separate contracts in accordance with Article 15 shall forever waive the Contractor's right to pursue the claim against the Owner.

§ 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/Project Expediter shall provide or designate who shall provide for coordination of the activities of the general contractor's own forces and 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/Project Expediter 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 Project Expediter, Contractor, separate contractors and the Owner 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 have the same rights that 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, 11 and 12.

§ 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 Project Expediter and Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's 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 Damages and costs caused by delays or by improperly timed activities or defective construction shall be borne by the party responsible therefor. The Contractor shall reimburse the Owner for any costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Contractor shall also reimburse the Owner for any other damages incurred by the Owner as a result of the Contractor's delays, improperly timed activities or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.2.6 In accordance with N.C. Gen. Stat. § 143-128, the Contractor shall be directly liable to the Owner and to the other separate prime contractors for the full performance of all duties and obligations due respectively under the terms of the separate contracts and in accordance with the plans and specifications of the Project.

§ 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, the Owner may clean up and the Architect will allocate the cost among those responsible. This provision shall not impose any obligation on the Owner to clean up the site if the Owner is not performing separate construction activities related to the Project.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

§ 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 Architect; a Construction Change Directive requires agreement by the Owner and Architect 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 Architect alone with the prior written approval of the Owner.

§ 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.

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 The execution of a Change Order by the parties shall represent a final resolution to all issues addressed by the Change Order and shall constitute a waiver of any claim the Contractor may have to additional compensation or any adjustment to the Contract Time. The Owner, however, reserves the right to audit and confirm that the quantity of work performed was equal to the quantity contained in any Change Order in which payment is based upon unit prices or time and materials. The Owner shall be entitled to receive a credit for any overage contained in the Change Order. In order to receive the credit, the Owner must initiate the audit within thirty (30) days of substantial completion of the Project. The Contractors shall provide the Owner with reasonable access to any documents required to conduct the audit.

§ 7.2.3 The methods used in determining adjustments to the Contract Sum shall be the same as noted in Section 7.3.3 below.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, 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 Contract Time 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 Section 7.3.7.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect 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 Contract Time.

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

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment 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, an allowance for overhead and profit in accordance with paragraph 7.3.11 and subparagraphs 7.3.11.1 through 7.3.11.6 below. . In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

- .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- .5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. 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 or decrease.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment in amounts not in dispute for Work completed under the Construction Change Directive in Applications for Payment accompanied by a Change Order indicating the parties' agreement with part or all of such costs. For any portion of such cost that remains in dispute, the Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect shall prepare a Change Order accurately recording the agreement. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.3.11 In subparagraphs 7.3.6 and 7.3.7, the allowance for the combined overhead and profit included in the total cost to the Owner, including bonds, insurance, bookkeeping, clerical, estimating,

superintendence, project management, and all other indirect or overhead costs shall not exceed the following:

- .1 for the Contractor, for work performed by the Contractor's own forces, 15 percent of the cost;
- .2 for the Contractor, for work performed by the Contractor's subcontractor, 10 percent of the amount due the subcontractor;
- .3 for each subcontractor or sub-subcontractor involved, for work performed by that subcontractor's or sub-subcontractor's own forces, 10 percent of the cost;
- .4 for each subcontractor, for work performed by the subcontractor's sub-subcontractor, 10 percent of the amount due the sub-subcontractor;
- .5 cost to which overhead and profit is to be applied shall be determined in accordance with subparagraph 7.3.7;
- .6 in order to facilitate checking of quotations for extras for credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by complete itemization of costs including labor, materials, and subcontracts utilizing a format approved by the Architect. Labor and materials shall be itemized in the manner described above. Where major cost items are subcontracts, they shall be itemized also. In no case will a change involving over \$100 be approved without such itemization.

§ 7.4 MINOR CHANGES IN THE WORK

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents with the prior written approval of the Owner. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor. The Contractor shall carry out such orders promptly.

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

§ 8.1.1 Unless otherwise provided, Contract Time 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.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 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 and Contractor's construction schedule, as integrated by the general contractor and as approved by the Architect as to completion date, are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 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 Article 11 to be furnished by the Contractor. The date of commencement of the Work shall not be changed by the effective date of such insurance.

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

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 The time during which the Contractor is delayed in the performance of the work by the acts or omissions of the Owner, Architect or their employees or agents, acts of God, unusually severe and abnormal climatic conditions, fires, floods, epidemics, quarantine restrictions, strikes, riots, civil commotions or freight embargoes, issuance of building permits by authorities having jurisdiction over the Project, or other conditions beyond the Contractor's control and which the Contractor could not reasonably have foreseen and provided against, shall be added to the time for completion of the Work (i.e. the contract time) stated in the Agreement; provided, however, that no claim by the Contractor for an extension of time for delays will be considered or allowed unless made in compliance with the requirements of the Contract Documents, including Article 15 of this Agreement.

§ 8.3.1.1 Should a time extension be granted for substantial completion, an equal extension shall be applied to the date for final completion, unless specifically stated otherwise.

§ 8.3.1.2 Neither the Owner nor the Architect shall be obligated or liable to the Contractor for, and the Contractor hereby expressly waives, any claims against the Owner and the Architect on account of any indirect or direct damages, costs, or expenses of any nature (including extended overhead or additional personnel costs) which the Contractor, its subcontractors, or sub-subcontractors or any other person may incur as a result of any delays, interferences, changes in sequence or the like, which are identified in Section 8.3.1 above or which are reasonable, foreseeable, contemplated, or avoidable by Contractor, arising from or out of any act or omission of any governmental representative (excluding the Owner) or any of the other multiple prime contractors, it being understood and agreed that the Owner's only obligation in any such events shall be an extension of the contract time, but only as determined in accordance with the provisions of the Contract Documents, including Article 15, unless said delay, interference or change in sequence is solely caused by the Owner and/or Architect. Under no circumstances shall the Contractor be entitled to additional compensation from the Owner or Architect for any claim for delays, interferences, changes in sequence or the like, unless said delay, interference or change in sequence is solely caused by the Owner and/or Architect, except under no circumstances shall the Contractor be entitled to additional compensation for lost profits, home office overhead or lost business opportunity.

§8.3.2. Subject to other provisions of the contract, the Contractor may be entitled to an extension of the contract time (but no increase in the contract sum) for delays arising from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, his subcontractors, or suppliers as follows:

.1 labor disputes and strikes (including strikes affecting transportation) that do, in fact, directly and critically affect the progress of the Work; however, and extension of contract time on account of an individual labor strike shall not exceed the number of days of said strike;

.2 acts of God, tornado, fire, hurricane, blizzard, earthquake, typhoon, or flood that damages completed work or stored materials;

.3 abnormal inclement weather; however, the contract time will not be extended due to normal inclement weather. The time for performance of this contract, as stated in the contract documents, includes an allowance for calendar days which may not be available for construction out-of-doors (prior to building dry-in), unless the Contractor can substantiate to the satisfaction of the Owner that there was greater than normal inclement weather considering the full term of the contract time for work to be performed out of doors (prior to building dry-in) using a ten year average of accumulated record mean values from climatological data compiled by the U.S. Department of Commerce National Oceanic and Atmospheric Administration for the locale of the Project and that such alleged greater than normal inclement weather actually delayed the work or portions thereof which had an effect upon the contract time, the Contractor shall only be entitled to an extension of time if the total accumulated number of

calendar days lost due to inclement weather, from the start of work until building dry-in exceeds the total accumulated number to be expected for the same period based on the ten-year average. Time for completion will be extended by the number of calendar days needed to include the excess number of calendar days lost.

.4 Acts of the public enemy, acts of the State, federal, or local government in its sovereign capacity, and acts of another Contractor in the performance of a contract with the Owner relating to the Project.

§ 8.3.3 The burden of proof to substantiate a claim for an extension of the contract time shall rest with the Contractor, including evidence that the cause was beyond his control. The Architect shall base its findings of fact and decision on such justification and supporting evidence and shall advise the Contractor in writing thereof. If the Architect finds that the Contractor was delayed on activities that were on the schedule's critical path, the Architect's determination of the total number of days extension shall be based upon the currently approved progress schedule and on all data relevant to the extension. Such data will be incorporated into the schedule in the form of a revision thereto, accomplished in a timely manner. The Contractor acknowledges and agrees that delays in activities which, according to the schedule, do not affect the contract time of the schedule's critical path, do not have any effect upon the Project's contract time and therefore will not be the basis for an extension of time. The Contractor acknowledges and agrees that time extensions will be granted only to the extent that excusable delays adversely impact critical path activities on the Contractor's schedule. Notwithstanding the above, the Contractor further agrees that if the currently approved schedule is a recovery schedule intended to address delays caused by the Contractor or for which the Contractor was not entitled to an extension of time, the Architect shall be allowed to assess the impact of the delays caused by the Contractor in determining whether the Contractor shall be granted an extension to the contract times.

§ 8.3.4. Extensions in the contract time by Change Orders are subject to an extension-of-time audit by the Owner as follows: (1) The Contractor agrees that, even though the Owner, Contractor, and Architect have previously signed a Change Order containing an extension of time resulting from a change in or addition to the Work that extension in the contract time may be adjusted by an audit after the fact by the Owner. If such an audit is to be made, the Owner must undertake the audit and make a ruling within 30 days after the completion of the Work under the Change Order. (2) The Contractor agrees that any extension of the contract time to which he is entitled arising out of a Change Order undertaken on a force accounting (labor and materials) basis shall be determined by an extension-of-time audit by the Owner or Architect after the work of the Change Order is completed. Such rulings shall be made by the Owner or Architect within 30 days after a request for same is made, except said 30 days will not start until the work under the Change Order is completed.

§ 8.3.5. The Contractor shall not be entitled to and hereby expressly waives any extension of time resulting from any condition or cause unless said claim for extension of time is made in writing to the Architect as required by Article 15.2. Circumstances and activities leading to such claim shall be indicated or referenced in a daily field inspection report for the day(s) affected; otherwise, all such claims are waived by the Contractor. In every such written claim, the Contractor shall provide the following information: (1) nature of delay; (2) date (or anticipated date) of commencement of delay; (3) activities on the progress schedule affected by the delay and/or new activities created by the delay and their relationship with existing activities; (4) identification of person(s) or organization(s) or event(s) responsible for the delay; (5) anticipated extent of the delay; and (6) recommended action to avoid or minimize the delay.

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

The Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values prepared as required under Section 9.2., for completed portions of the Work. Such application shall be notarized and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.1.3 The Owner will retain five percent of the amount of each progress payment on the Project for as long as is authorized by N.C. Gen. Stat. § 143-134.1. At all times during the Project, the Owner shall retain the maximum funds allowed by N.C. Gen. Stat. § 143-134.1. The Owner specifically reserves the right to withhold additional funds as authorized by this Agreement or N.C. Gen. Stat. § 143-134.1.

§ 9.3.2 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 in its sole discretion, 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 the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 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 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.

§ 9.3.4 The Contractor with each application for payment submitted shall include a list of those minority business enterprises subcontractors whose work is included in the application and the amount due each.

By including the minority business enterprises on the list, the contractor certifies that the minority business enterprise performed the work or services or provided supplies under the contract and was not acting as a mere conduit.

§ 9.3.5 The Contractor shall submit with each application for payment documentation in a form acceptable to the Owner showing all sales tax paid by the Contractor for all work and materials covered by the application for payment.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within ten 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 Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's observations and evaluation of the Work and the data comprising the Contractor's Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated in the Application for Payment; that the quality of the Work is in accordance with the Contract Documents; and that the Work has been performed in a good workmanlike fashion, subject (1) to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, (2) to results of subsequent tests and inspections required by or performed under the Contract Documents, (3) to correction of minor deviations from the Contract Documents prior to completion, and (4) to specific qualifications expressed by the Architect in the Certificate for Payment. The issuance of a Certificate for Payment will further constitute a representation by the Architect that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has reviewed construction means, methods, techniques, sequences or procedures or made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or another contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;

- .7 failure to carry out the Work in accordance with the Contract Documents;
- .8 failure to provide sales tax documentation in accordance with subparagraph 9.3.5;
- .9 failure or refusal of the Contractor to submit the required information on minority business enterprises;
- .10 additional services provided by the Architect pursuant to paragraph 9.6.8; or
- .11 any other reason deemed necessary by the Architect to protect the Owner.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld. No interest shall be added to any amounts withheld pursuant to Article 9.5.

§ 9.5.3 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option and in its sole discretion, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment. No interest shall be added to any amounts withheld pursuant to this provision.

§ 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect 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 Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor no later than seven days after receipt of payment from the Owner and in accordance with N.C. Gen. Stat. § 143-134.1 the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner and in accordance with N.C. Gen. Stat. § 143-134.1.

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

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect 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.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 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.

§ 9.6.8 The Contractor shall reimburse the Owner or the Owner will retain from the compensation otherwise to be paid to the Contractor funds sufficient to cover the payment of the following additional services performed by the Architect: (1) services required pursuant to the Owner's dispute resolution policy; (2) expense of overtime work requiring higher than regular rates when such work is required due to the failure of the Contractor to perform in accordance with the Contract Documents; (3) review of the Contractor's submittal or shop drawing out of sequence of the submittal schedule agreed to by the

Contractor and Architect; (4) responses to the Contractor's requests for information where such information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior project correspondence or documentation; (5) evaluation of an extensive number of substitutions proposed by the Contractor and making subsequent revisions to instruments of service resulting therefrom; (6) design services related to the default of the Contractor; (7) contract administration services provided 60 days after the date of substantial completion of the work if required due to the Contractor's failure to complete its punchlist work in a timely fashion; (8) more than two inspections or reviews of the same area or areas for the purpose of determining substantial completion of the area or areas; (9) more than two inspection or reviews of the same area or areas for the purpose of determining final completion of the area or areas; and (10) multiple reviews of an incomplete or deficient submittal or shop drawing from the Contractor.

§ 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within fourteen days after receipt of the Contractor's Application for Payment, or if the Owner absent just cause does not pay the Contractor within fourteen days after the date established in the Contract Documents the amount certified by the Architect, then the Contractor may, upon fourteen additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, as provided for in the Contract Documents.

§ 9.8 SUBSTANTIAL COMPLETION

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

§ 9.8.2 When the Contractor considers that the Project, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall in good faith prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete the Project in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Project or designated portion thereof is substantially complete. The Architect shall have no obligation to make an inspection to determine whether the Project is substantially complete until the Contractor prepares the Contractor's comprehensive list of items to be completed or corrected prior to final payment. If the Architect determines that the Contractor's list is excessive or through its observations it determines that the Project is not substantially complete, the Architect may require the Contractor to perform additional work prior to the Architect's inspection of the Project. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Project or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When in the Architect's professional opinion the Project or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor

for security, maintenance, heat, utilities, damage to the Project 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 Project or designated portion thereof unless otherwise provided by the Architect in the Certificate of Substantial Completion. The Architect shall be solely responsible for establishing the date of Substantial Completion.

§ 9.8.5 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. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Project or designated portion thereof. Such payment shall be adjusted for instances when the Project is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Project at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion of the Project 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 Project and insurance, and have agreed in writing concerning the period for correction of the Project and commencement of warranties required by the Contract Documents. When the Contractor considers a portion of the Project substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Project shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

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

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

§ 9.9.4 The Owner's partial use or occupancy of the Project shall not be construed as a declaration by the Owner or Architect that the building is substantially complete unless specifically stated in writing by the Owner or Architect. The Owner's partial occupancy or use of the Project shall not prevent the Owner from assessing liquidated damages for the entire Project through the actual date of substantial completion of the Project.

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief and in his/her professional opinion, and on the basis of the Architect's on-site visits 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 the final Certificate is due and payable. The Architect's final Certificate for

Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (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 Contract Documents 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, (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner and (6) documentation regarding all of the sales tax paid by the Contractor 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.

§ 9.10.3 If, after Substantial Completion of the Project, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Project fully completed and accepted. If the remaining balance for the Project or portion thereof not fully completed or corrected is less than retainage stipulated in the Contract Documents, the written consent of surety to payment of the balance due for that portion of the Project fully completed and accepted shall be submitted by the Contractor to the Architect 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.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents;
- .4 failure of the work to be performed in a good workmanlike manner;
- .5 conditions not recognized by the Owner at the time of payment; or
- .6 those claims reserved by the Owner at or before the time of payment.

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

§ 9.10.6 Application for final payment for each prime contract shall be accompanied by executed and notarized copies of AIA Document G706, Contractor's Affidavit of Payment of Debts and Claims, AIA Documents G706A, Contractor's Affidavit of Release of Liens, and AIA Document G707, Consent of Surety Company to Final Payment, and an affidavit that no materials containing asbestos were used on the Project. In addition, each prime contractor shall furnish separate releases or liens from each subcontractor and materials and equipment supplier involved in its portion of the Work.

§ 9.11 LIQUIDATED DAMAGES

§9.11.1 The damages incurred by the Owner due to the Contractor's failure to complete the work within the required contract time, including any extensions thereof, shall be in the amount set forth in the Contract Documents, for each consecutive day beyond the established contract time (Saturdays, Sundays and all holidays included) for which the Contractor shall fail to complete the work. Should the Contractor fail to substantially complete the Project on or before the date stipulated for substantial completion (or such later date as may result from extension of time granted by Owner), he shall pay the Owner, or the Owner will retain as liquidated damages, the sum identified in the Contract Documents for substantial completion for each consecutive calendar day that terms of the contract remain unfulfilled beyond the date allowed by the contract, which sum is agreed upon as a reasonable and proper measure of damages which the Owner will sustain per day by failure of the Contractor to complete the Project within time as stipulated; it being recognized by the Owner and the Contractor that the injury to the Owner which could result from a failure of the Contractor to complete on schedule is uncertain and cannot be computed exactly. In no way shall costs for liquidated damages be construed as a penalty on the Contractor.

§ 9.11.2 For each consecutive calendar day that the Work and/or Project remains incomplete after the date established for final completion, the Contractor shall pay or Owner will retain from the compensation otherwise paid to the Contractor the sum identified in the Contract Documents as final completion liquidated damages for each consecutive day that the Project remains incomplete. This amount is the minimum measure of damages the Owner will sustain due to the delay in the completion of all remedial work, the delay in the correction of deficient work, the disruption to the school and the learning environment, and the inability to use the facilities fully. This amount is in addition to the liquidated damages prescribed above for substantial completion.

§ 9.11.3 If it is determined that the Contractor was delayed at any time in the progress of the work by acts or omissions of the Owner, Architect or their employees or agents and no time extension was granted for the delay, then the Contractor shall not be assessed liquidated damages for any delay caused by the Owner, Architect or their employees or agents.

§ 9.11.4 The liquidated damages set forth in Articles 9.11.1 and 9.11.2 above shall be assessed cumulatively. This provision for liquidated damages does not bar Owner's right to enforce other rights and remedies against Contractor, including but not limited to, specific performance or injunctive relief.

§ 9.11.5 The liquidated damages set forth in Articles 9.11.1 and 9.11.2 above shall not include legal or additional design professional fees that result from termination for cause of the Contractor's contract. If such legal or additional design professional fees are incurred by the Owner, the Contractor shall be liable to the Owner for those costs in addition to the liquidated damages amount set forth above and in the Contract Documents.

§ 9.11.6 The liquidated damages set forth in Articles 9.11.1 and 9.11.2 above shall not include legal or additional design professional costs that are incurred by the Owner in responding to concerns with the Contractor's performance that result in the Owner sending notice of consideration of the termination of the Contractor's contract to the Surety and Contractor. If such legal or additional design professional costs are incurred by the Owner, the Contractor shall be liable to the Owner for those costs in addition to the liquidated damages amount set forth above and in the Contract Documents.

§ 9.11.7 The Owner's entitlement to liquidated damages shall not be considered a "Claim" subject to any time limitation for asserting Claims, but rather accrues automatically upon the Contractor's failure to meet the substantial completion date and/or final completion date.

§ 9.11.8 The Owner's partial use or partial occupancy of the Project shall not be construed as a declaration by the Owner or Architect that the building is substantially or finally complete, unless specifically stated in writing by the Owner or Architect. The Owner's partial occupancy or use of the Project shall not prevent the Owner from assessing liquidated damages for the entire Project through the actual dates of substantial and final completion.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

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

§ 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

- .1 employees on the Project and other persons who may be affected thereby;
- .2 the Project and all 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
- .3 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 comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and 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 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 the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.4.1 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary, the Contractor shall give the applicable State and local government officials and the Owner reasonable advance notice.

§ 10.2.5 The Contractor shall promptly remedy damage and loss to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a 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 Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, 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 Section 3.18.

§ 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 unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage, create an unsafe condition, or create a risk of endangering its safety.

§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY

If the Contractor suffers injury or damage to person or property because of an act or omission of the Owner, or of others for whose acts the Owner is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the Owner within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the Owner to investigate the matter.

§ 10.2.9 Contractor acknowledges that he will be performing the Work on a school site and that a construction site might be an “attractive nuisance” which might draw children to said site. Contractor agrees that it will take reasonable precautions necessary to prevent children from entering the construction site or an area where materials are stored.

§ 10.2.10 Contractor and its subcontractors shall not bring any weapons, firearms or alcoholic beverages on any of the Owner’s property.

§ 10.2.11 The Contractor will comply with the Occupational Safety and Health Act of 1970 (OSHA) including all federal and State standards and regulations which have been or shall be promulgated thereunder or in accordance therewith. The Contractor shall be responsible for all citations, assessments, fines, penalties, and delays in the performance of any work on the Project incurred by reason of failure or failure on the part of its agents, employees, assignees or subcontractors to comply. The Contractor shall also comply with all applicable laws, ordinances, rules, regulations, and lawful orders of any public authority having jurisdiction for the safety of persons or property.

§ 10.3 HAZARDOUS MATERIALS

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

§ 10.3.2 Upon receipt of the Contractor’s written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such hazardous material or substance is found to be present, to cause it to be rendered harmless or to verify that it has already been rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has a reasonable objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor’s reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area after the Owner has been informed in writing of the presence of the material or substance, if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that 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), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor or its subcontractor brings to the site.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and/or negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, unless the cost and expense are due to the Owner's fault or negligence.

§ 10.4 EMERGENCIES

In an emergency affecting 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 Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1** Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- .2** Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3** Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4** Claims for damages insured by usual personal injury liability coverage;
- .5** Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6** Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- .7** Claims for bodily injury or property damage arising out of completed operations; and
- .8** Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages shall be written on an occurrence basis and, shall be maintained without interruption from the date of

commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.2.1 Liability insurance shall include all major divisions of coverage and be on a comprehensive basis including:

- .1 premises operations (including X, C, and U coverages as applicable).
- .2 independent contractor's protective.
- .3 products and completed operations.
- .4 personal injury liability with employment exclusion deleted.
- .5 contractual, including specified provision for Contractor's obligation under Paragraph 3.18.
- .6 owned, non-owned and hired motor vehicles.
- .7 broad form property damage including completed operations.

§ 11.1.2.2 If the general liability coverages are provided by a commercial general liability policy on a claims-made basis, the policy date or retroactive date shall predate the contract; the termination date of the policy or applicable extended reporting period shall be no earlier than the termination date of coverages required to be maintained after final payment, certified in accordance with subparagraph 9.10.2.

§ 11.1.2.3 The insurance required by subparagraph 11.1.1 shall be written for not less than the following limits or greater if required by law:

1. Worker's Compensation:
 - a. State: Statutory
 - b. Applicable Federal: Statutory
 - c. Employer's liability:
 - i. \$100,000 each accident
 - ii. \$1,000,000 disease policy limit
 - iii. \$100,000 disease, each employee
2. Comprehensive or Commercial General Liability
 - a. Limits of Insurance (CSL)
 - i. \$1,000,000 each occurrence
 - ii. \$1,000,000 aggregate
 - b. Products and Completed Operations to be Maintained for One Year After Final Payment
 - i. \$1,000,000 aggregate
 - c. Property Damage Liability Insurance Shall Provide X, C, and U Coverage
 - d. Broad Form Property Damage Coverage Shall Include Completed Operations
3. Contractual Liability (Hold Harmless Coverage):
 - a. Limits of Insurance (CSL):
 - i. \$1,000,000 each occurrence
 - ii. \$1,000,000 aggregate
4. Personal Injury, with Employment Exclusion Deleted: \$1,000,000 aggregate
5. Business Auto Liability (Including Owned, Non-Owned, and Hired Vehicles):
 - a. Limits of Insurance (CLS):
 - i. \$500,000
6. If the General Liability Coverages are Provided by a Commercial Liability Policy, The:
 - a. General aggregates shall be not less than \$1,000,000 and it shall apply, in total, to this Project only;

- b. Fire damage limit shall be not less than \$50,000 on any one fire; and
 - c. Medical expense limit shall be not less than \$5,000 on any one person.
7. Umbrella Excess Liability:
- a. \$1,000,000 over primary insurance;
 - b. \$10,000 retention.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness. If this insurance is written on the comprehensive liability policy, the certificates shall be AIA Document G705, Certificate of Insurance. If this insurance is written on a commercial general liability policy form, accord form 25S will be acceptable.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner as additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.1.5 Each prime contractor shall either require each of his subcontractors to procure and maintain during the life of his subcontract insurance of the types and amounts described in Paragraph 11.1.2.1 above or he shall insure the activities of his subcontractors in his own policy.

§ 11.1.6 The Contractor shall not commence work under this contract until he has obtained all the insurance and bonds required hereunder and such insurance and bonds have been accepted by the Owner. Nor shall the Contractor allow any subcontractor to commence work on his subcontract until all similar insurance and bonds required of the subcontractor have been so obtained and accepted. Acceptance of the insurance by the Owner shall not constitute an approval of the insurance as meeting the requirements of the Contract Documents nor relieve or decrease the liability of the Contractor hereunder.

§ 11.2 OWNER'S LIABILITY INSURANCE

The Owner may purchase and maintain the Owner's usual liability insurance, and the Contractor shall purchase and maintain insurance covering the Owner's contingent liability for claims which may arise from operations under the contract.

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 The Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has

an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project. The form of policy for this coverage shall be completed value. If the Owner is damaged by failure of the Contractor to maintain such insurance, then the Contractor shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.1 Property insurance shall be on an “all-risk” or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect’s and Contractor’s services and expenses required as a result of such insured loss.

§ 11.3.1.3 If the property insurance requires deductibles, the Contractor shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 BOILER AND MACHINERY INSURANCE

The Contractor shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner’s option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner’s property due to fire or other hazards, however caused.

§ 11.3.6 Prior to commencement of the Work, the Contractor shall file with the Owner a certificate of insurance for the policy or policies providing the property insurance coverage required for this Project. The certificate of insurance shall contain a provision that the policy will not be cancelled or allowed to expire until at least 30 days prior written notice has been given to the Owner.

§ 11.3.7 WAIVERS OF SUBROGATION

The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect’s consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered and reimbursed by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Contractor as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect’s consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-

subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under this property insurance shall be adjusted by the Contractor as fiduciary and made payable to the Contractor as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Contractor as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Contractor's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Contractor shall deposit in a separate account proceeds so received, which the Contractor shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss due to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Contractor shall furnish bonds satisfactory to the Owner and from a company licensed by the State of North Carolina to issue such bonds covering the faithful performance of the contract and payment of obligations arising thereunder as required by law. The cost of the Contractor's bonds shall be included in the contract sum. The amount of the performance bond and the labor and material payment bonds shall each be equal to 100 percent of the contract sum. These bonds shall be maintained in full force and effect throughout the full term of the contract.

§ 11.4.1.1 The Contractor shall deliver the required bonds to the Owner when he delivers the executed contracts to the Architect, or if the work is to be commenced prior thereto, in response to a letter of intent, the Contractor shall, prior to the commencement of the work, submit evidence satisfactory to the Owner that such bonds will be furnished.

§ 11.4.1.2 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

§ 11.4.2 Upon the request to the Contractor of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.5 INSURANCE COMPANY QUALIFICATIONS

§ 11.5.1 All insurance and bonds required by this contract shall be written by a company or companies having a rating of "A" or above by A.M. Best Company and which are licensed and authorized to do business in North Carolina.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may, with the consent of the Owner, request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the party responsible shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Sections 3.5 and 12.2.1, if, within one year after the date of Substantial Completion of the Project or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, 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. The Owner shall give such notice promptly after discovery of the condition. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work 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 completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

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

§ 12.2.4 The Contractor or its surety 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 or its surety's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work pursuant to Section 12.2, 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.

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

If the Owner prefers to accept Work that 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. Any acceptance of nonconforming work must be in writing.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

§ 13.1.1 The Contract shall be governed by the law of the State of North Carolina.

§ 13.1.2 Each and every provision of law and clause required by law to be inserted in this contract shall be deemed to be inserted herein and the contract shall be read and enforced as though it were included herein. If, through mistake or otherwise, any such provisions are not inserted or are not correctly or fully inserted, then upon the application of either party, the contract shall forthwith be physically amended to make such insertion.

§ 13.1.3 Whenever possible, each provision of this Agreement shall be interpreted in a manner as to be effective and valid under applicable law. If, however, any provision of this Agreement, or portion thereof, is prohibited by law or found invalid under any law, only such provision or portion thereof shall be ineffective, without in any manner invalidating or affecting the remaining provisions of this Agreement or valid portions of such provisions, which are hereby deemed severable.

§ 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, 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.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to the local board of county commissioners or a lender providing construction financing for the Project, if the party assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to 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 or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 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.

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as specifically stated in the Contract or as may be specifically agreed in writing.

§ 13.4.3 Each party hereto agrees to do all acts and things and to make, execute and deliver such written instruments, as shall from time to time be reasonably required to carry out the terms and provisions of the Contract Documents.

§ 13.4.4 Any specific requirements in this Contract that the responsibilities or obligations of the Contractor also apply to a Subcontractor is added for emphasis and are also hereby deemed to include a Subcontractor to any tier. The omission of a reference to a Subcontractor in connection with any of the Contractor's responsibilities or obligations shall not be construed to diminish, abrogate, or limit any responsibilities or obligations of a Subcontractor of any tier under the Contract Documents or the applicable subcontract.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. 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 shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals for which applicable laws or regulations expressly prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect 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 Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 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 Architect.

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

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

§ 13.6 INTEREST

Payments due and unpaid under the Contract Documents shall not bear interest.

§ 13.8 CONDUCT ON SITE

§ 13.8.1 In accordance with N.C. Gen. Stat. § 14-269.2, the Contractor, its subcontractors and employees shall not possess or carry, whether openly or concealed, any gun, rifle, pistol, or explosive on any property owned by the Owner. This includes firearms locked in containers, vehicles or firearm racks within vehicles. The Contractor, its subcontractors and employees shall not cause, encourage or aid a minor, who is less than 18 years old to possess or carry, whether openly or concealed, any weapons on any property owned by the Owner.

§ 13.8.2 The Contractor, its subcontractors and employees, are prohibited from profane, lewd, obscene or offensive conduct or language, including engaging in sexual harassment.

§ 13.8.3 The Contractor and its subcontractors and their employees shall not manufacture, transmit, conspire to transmit, possess, use or be under the influence of any alcoholic or other intoxicating beverage, narcotic drug, hallucinogenic drug, amphetamine, barbiturate, marijuana or anabolic steroids, or possess, use, transmit or conspire to transmit drug paraphernalia on any property owned by the Owner.

§ 13.8.4 The Contractor, its subcontractors and employees shall not solicit from or sell to students or staff within the Owner's facilities or campuses, and shall not give gifts of any value to school system employees.

§ 13.8.5 The Contractor, its subcontractors and employees are prohibited from using access to the site pursuant to this Contract as a means to date, court, or enter into a romantic or sexual relationship with any student enrolled in the Owner's school system. The Contractor agrees to indemnify the Owner for claims against the Owner resulting from relationships which have occurred or may occur between a student and an employee of the Contractor or subcontractor.

§ 13.8.6 The Contractor, its subcontractors and employees shall not interact with any students. However, nothing in this section shall be construed to prevent the Contractor, its subcontractors and employees from taking necessary measures to protect the safety of students, staff, or other employees.

§ 13.8.7 The Contractor shall at all times enforce strict discipline and good order among its employees and shall not employ any unfit person or anyone not skilled in the task assigned to it. The Owner may require the Contractor to remove any employee the Owner deems incompetent, careless or otherwise objectionable.

§ 13.9 COMPLIANCE WITH APPLICABLE LAWS

§ 13.9.1 Lunsford Act/Criminal Background Checks. The Contractor shall conduct at its own expense sexual offender registry checks on each of its owners, employees, agents, or subcontractors ("contractual personnel") who will engage in any service on or delivery of goods to school system property or at a school-system sponsored event, except checks shall not be required for individuals who are solely delivering or picking up equipment, materials, or supplies at: (1) the administrative office or loading dock

of a school; (2) non-school sites; (3) schools closed for renovation; or (4) school construction sites.. The checks shall include at a minimum checks of the State Sex Offender and Public Protection Registration Program, the State Sexually Violent Predator Registration Program, and the National Sex Offender Registry (“the Registries”). For the Contractor’s convenience only, all of the required registry checks may be completed at no cost by accessing the United States Department of Justice Sex Offender Public Website at [http:// www. nsopw.gov/](http://www.nsopw.gov/). The Contractor shall provide certification that the registry checks were conducted on each of its contractual personnel providing services or delivering goods under this Agreement prior to the commencement of such services or the delivery of such goods. The Contractor shall conduct a current initial check of the registries (a check done more than 30 days prior to the date of this Agreement shall not satisfy this contractual obligation). In addition, Contractor agrees to conduct the registry checks and provide a supplemental certification before any additional contractual personnel are used to deliver goods or provide services pursuant to this Agreement. Contractor further agrees to conduct annual registry checks of all contractual personnel and provide annual certifications at each anniversary date of this Agreement. Contractor shall not assign any individual to deliver goods or provide services pursuant to this Agreement if said individual appears on any of the listed registries. Contractor agrees that it will maintain all records and documents necessary to demonstrate that it has conducted a thorough check of the registries as to each contractual personnel, and agrees to provide such records and documents to the school system upon request. Contractor specifically acknowledges that the school system retains the right to audit these records to ensure compliance with this section at any time in the school system’s sole discretion. Failure to comply with the terms of this provision shall be grounds for immediate termination of the Agreement. In addition, the Owner may conduct additional criminal records checks at the Owner’s expense. If the school system exercises this right to conduct additional criminal records checks, Contractor agrees to provide within seven (7) days of request the full name, date of birth, state of residency for the past ten years, and any additional information requested by the school system for all contractual personnel who may deliver goods or perform services under this Agreement. Contractor further agrees that it has an ongoing obligation to provide the school system with the name of any new contractual personnel who may deliver goods or provide services under the Agreement. The Owner reserves the right to prohibit any contractual personnel of Contractor from delivering goods or providing services under this Agreement if the Owner determines, in its sole discretion, that such contractual personnel may pose a threat to the safety or well-being of students, school personnel or others.

§ 13.9.2. Compliance with Applicable Laws. Contractor shall comply with all applicable laws and regulations in providing services under this Agreement. In particular, Contractor shall not employ any individuals to provide services to the Owner who are not authorized by federal law to work in the United States. Contractor represents and warrants that it is aware of and in compliance with the Immigration Reform and Control Act and North Carolina law (Article 2 of Chapter 64 of the North Carolina General Statutes) requiring use of the E-Verify system for employers who employ twenty-five (25) or more employees and that it is and will remain in compliance with these laws at all times while providing services pursuant to this Agreement. Contractor shall also ensure that any of its subcontractors (of any tier) will remain in compliance with these laws at all times while providing subcontracted services in connection with this Agreement. Contractor is responsible for providing affordable health care coverage to all of its full-time employees providing services to the School System. The definitions of “affordable coverage” and “full-time employee” are governed by the Affordable Care Act and accompanying IRS and Treasury Department regulations.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment in the amount approved by the Architect on a Certificate for Payment within the time stated in the Contract Documents and after an additional 30 days notice to the Owner and Architect and an opportunity to cure; or
- .4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work solely by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon fifteen (15) days' written notice to the Owner and Architect and a reasonable opportunity to cure, terminate the Contract and recover from the Owner payment for Work executed prior to the date of termination as allowed in the Contract, including reasonable overhead and profit to the date of termination as allowed in the Contract, and actual and verifiable costs incurred by reason of such termination as allowed in the Contract and proven by the Contractor through valid documentation of such expenses incurred..

§ 14.1.4 If the Work is stopped for a period of 120 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon fourteen (14) additional days' written notice to the Owner and the Architect and an opportunity to cure, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority.
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents;
- .5 refuses or fails to prosecute the work or any separable part thereof with such diligence as will ensure the Substantial or Final Completion of the Work within the Contract Time or fails to complete the Work or remedy a default within said period; or
- .6 refuses or fails to properly schedule, plan coordinate and execute the Work, as specified herein, so as to perform the Work within the specified milestone and completion dates, or to provide scheduling or related information, revisions and updates as required by the Contract Documents;

7. fails to comply with (1) the provisions of the Sedimentation and Pollution Control Act (N.C. Gen. Stat. §113A-50 *et seq.*), and/or (2) any Notice of Violation issued by the North Carolina Department of Natural Resources.

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Architect 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 days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished, and the Contractor shall reimburse the Owner for any legal or architectural fees incurred by the Owner as a result of the Contractor's default.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's and legal services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor or its Surety. If such costs and damages exceed the unpaid balance, the Contractor or its Surety shall pay the difference to the Owner. The amount to be paid to the Contractor, Surety or Owner, as the case may be, shall be certified by the Architect, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.2.5 If the Owner terminates the whole or any part of the Work pursuant to Section 14.2, the Owner may procure, upon such terms and in such manner as the Owner may deem appropriate, supplies or services similar to those so terminated, and the Contractor shall be liable to the Owner for any excess costs for such similar supplies or services. The Contractor shall continue the performance of the Contract to the extent not terminated hereunder.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

§ 14.3.1 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.

§ 14.3.2 If a suspension, delay, or interruption ordered by the Owner pursuant to Section 14.3.1 exceeds fourteen consecutive days, an adjustment shall be made for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

§ 14.4.1 The Owner may, at any time, terminate the Contract in whole or in part for the Owner's convenience and without cause.

§ 14.4.2 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 to the extent they relate to the Work terminated and enter into no further subcontracts and purchase orders.

§ 14.4.3 If the Owner terminates the whole or any portion of the Work pursuant to Section 14.4, then the Owner shall only be liable to the Contractor for those costs reimbursable to the Contractor in accordance with Section 14.4.4, plus a markup of 10 percent for profit and overhead on the actual fully accounted costs recovered under 14.4.4; provided however, that if there is evidence that the Contractor would have sustained a loss on the entire Contract had it been completed, no profit shall be included or allowed hereunder and an appropriate adjustment shall be made reducing the amount of the settlement to reflect the indicated rate of loss.

§ 14.4.3.1 After receipt of a Notice of Termination for Convenience, the Contractor shall submit to the Owner its termination claim in the form and with certification prescribed by the Owner. Such claims shall be submitted promptly but in no event later than three (3) months from the effective date of termination, unless one or more extensions in writing are granted by the Owner upon request of the Contractor made in writing within such three (3) month period or authorized extension thereof. However, if the Owner determines that the facts justify such action, it may receive and evaluate any such termination claim at any time after such three (3) month period or any extension thereof. Upon failure of the Contractor to submit its termination claim within the time allowed, the Owner may determine, on the basis of information available to it, the amount, if any, due to the Contractor by reason of the termination.

§14.4.4 If the Owner terminates the whole or any portion of the Work pursuant to Section 14.4, the Owner shall pay the Contractor the amounts determined by the Owner as follows:

- 14.4.4.1 an amount for supplies, services, or property accepted by the Owner pursuant to Subparagraph 14.5.1.6 or sold or acquired pursuant to Subparagraph 14.5.1.7 and not heretofore paid for, and to the extent provided in the Contract such amount shall be equivalent to the aggregate price for such supplies or services computed in accordance with the price or prices specified in the Contract appropriately adjusted for any saving of freight or other charges;
- 14.4.4.2 the total of the cost incurred in the performance of the Work through the date of termination including initial costs and preparatory expense allocable thereto but exclusive of any costs attributable to supplies or services paid or to be paid for under Section 14.4.4.1; and
- 14.4.4.3 Provided, however, that neither the Owner nor the Design Consultant will be liable for payments to subcontractors pursuant to Section 14.4.4.2 unless each subcontractor contains termination provisions identical to those set forth in Article 14. The Owner and the Design Consultant will not be liable to the Contractor or any of its subcontractors for any costs associated with termination if the subcontract of the party involved does not include the proper termination clauses.

§ 14.4.5 In arriving at any amount due the Contractor pursuant to Section 14.4, there shall be deducted the following:

- 14.4.5.1** all unliquidated advance or other payments on account theretofore made to the Contractor applicable to the terminated portion of the Contract;
- 14.4.5.2** any claim which the Owner may have against the Contractor;
- 14.4.5.3** such amount as the Owner determines to be necessary to protect the Owner against loss because of outstanding or potential liens or claims; and
- 14.4.5.4** the agreed price for, or the proceeds of sale of, any materials, supplies or other things acquired by the Contractor or sold pursuant to the provision of Section 14.5.1.7 and not otherwise recovered by or credited to the Owner.

§14.4.6. The total sum to be paid to the Contractor and Section 14.4 shall not exceed the Contract Sum as reduced by the amount of payments otherwise made or to be made for Work not terminated and as otherwise permitted by the Contract. Except for normal spoilage, and except to the extent that the Owner shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor, as provided in Section 14.4.4, the fair value, as determined by the Owner, of property which is destroyed, lost, stolen or damaged so as to become undeliverable to the Owner, or to a buyer pursuant to Section 14.5.1.7

§14.5 GENERAL TERMINATION FOR CONVENIENCE PROVISIONS

§ 14.5.1 After receipt of a notice of termination for convenience from the Owner, pursuant to Section 14.4, and except as otherwise directed by the Owner, the Contractor shall:

§ 14.5.1.1 stop work under the Contract on the date and to the extent specified in the notice of termination;

§14.5.1.2 place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the work under the Contract as is not terminated;

§14.5.1.3 terminate all orders and subcontracts to the extent that they relate to the performance of work terminated by the notice of termination;

§ 14.5.1.4 at the option of the Owner, assign to the Owner in the manner, at the times and to the extent directed by the Owner, all of the rights in the contracts so terminated, in which case the Owner shall have the right, at its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;

§ 14.5.1.5 settle all outstanding liabilities and all claims arising out of such termination or orders and subcontracts, with the approval or ratification of the Owner, to the extent it may require, which approval or ratification shall be final for all the purposes of this Article;

§ 14.5.1.6 transfer title and deliver to the entity or entities designated by the Owner, in the manner, at the times and to the extent directed by the Owner to the extent specifically produced or specifically acquired by the Contractor for the performance of such portion of the Work as had been terminated, the following:

- (1)** the fabricated or unfabricated parts, work in process, partially completed supplies and equipment, materials, parts, tools, dies, jigs and other fixtures, completed Work, supplies

and other material produced as part of, or acquired in connection with the performance of, the Work terminated by the notice of termination; and

- (2) the completed or partially completed plans, drawings, information, releases, manuals and other property related to the Work and which, if the Contract had been completed, would have been required to be furnished to the Owner;

§ 14.5.1.7 use its best efforts to sell, in the manner, at the times, to the extent and at the price or prices directed or authorized by the Owner, any property of the types referred to in Subparagraph 14.5.1.6; provided, however, that the Contractor:

- (1) shall not be required to extend credit to any buyer, and
- (2) may acquire any such property under the conditions prescribed by and at a price or prices approved by the Owner; and provided further that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the Owner to the Contractor under the Contract or shall otherwise be credited to the Contract Sum covered by the Contract or paid in such other manner as the Owner may direct;

§ 14.5.1.8 complete performance of such part of the Work as shall not have been terminated by the notice of termination; and

§ 14.5.1.9 take such action as may be necessary, or as the Owner may direct, for the protection and preservation of the property related to the Contract which is in the possession of the Contractor and in which the Owner has or may acquire an interest.

§ 14.5.2 The Contractor shall, from the effective date of termination until the expiration of three (3) years after final settlement under the Contract, preserve and make available to the Owner, at all reasonable times at the office of the Contractor, but without direct charge to the Owner, all its books, records, documents and other evidence bearing on the costs and expenses of the Contractor under the Contract and relating to the Work terminated hereunder, or, to the extent approved by the Owner, photographs, micro-photographs or other authentic reproductions thereof.

§ 14.5.3 If the termination for convenience, pursuant to Section 14.4, be partial, the Contractor may file with the Owner a claim for an equitable adjustment of the price or prices specified in the Contract relating to the continued portion of the Contract (the portion not terminated by the notice of termination), and such equitable adjustment as may be agreed upon shall be made in such price or prices. Any claim by the Contractor for an equitable adjustment under this Subparagraph must be asserted within three (3) months from the effective date of the notice of termination.

§ 14.5.4 The Contractor shall refund to the Owner any amounts paid by the Owner to the Contractor in excess of costs reimbursable under Section 14.4.

§ 14.5.5 The Contractor shall be entitled to only those damages and that relief from termination by the Owner as specifically provided in Section 14.4.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 CLAIMS

§ 15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, adjustment of Contract terms, 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 Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 TIME LIMITS ON AND NOTICE OF CLAIMS

Claims by the Contractor must be initiated by written notice to the Owner and the Architect. Claims by the contractor must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. The Contractor's failure to submit a claim in accordance with these time limits shall forever waive the Contractor's right to pursue the claim. The Contractor shall indemnify and hold the Owner harmless from any claims by the Contractor's subcontractors arising out of the Contractor's failure to submit the claim in a timely fashion.

§ 15.1.2.1 The resolution of a claim by change order shall finally resolve any and all claims arising from the event giving rise to the claim.

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments as requests for payment are substantiated by the Contractor and approved by the Architect. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with his/her exercise of professional judgment and the requirements of the Contract Documents, this Agreement, and AIA Document B101, 2007 Edition, as modified. The Contractor shall not slow or stop the progress of the Work while a claim or dispute is pending or under negotiation.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. The Contractor's failure to provide written notice of the Claim before proceeding to execute the Work shall be grounds for the denial of the Claim by the Architect and/or Owner. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, 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. The Contractor's claim shall specifically show the impact of the delay on the Project's critical path. The Contractor's failure to submit a claim in accordance with the time limits shall forever waive the Contractor's right to pursue the Claim.

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled critical path construction.

§ 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1** damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14 except it shall not apply to limit the Owner's ability to recover additional architectural and legal fees resulting from a default by the Contractor. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 INITIAL DECISION

§ 15.2.1 Claims by the Contractor, including those alleging an error or omission by the Architect but excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Architect for initial decision. The Architect will serve as the Initial Decision Maker. Except for those Claims excluded by this Section 15.2.1, an initial decision by the Architect shall be required as a condition precedent to litigation or mediation of any Claim by the Contractor arising prior to the date final payment is made, unless 30 days have passed after the Claim has been referred to the Architect with no decision having been rendered. The Architect may be granted an extension of time to render a decision by mutual agreement of the parties. The Owner may, in its sole discretion, submit its claims to the Architect for an initial decision before instituting mediation or litigation.

§ 15.2.2 The Architect will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Architect is unable to resolve the Claim if the Architect lacks sufficient information to evaluate the merits of the Claim or if the Architect concludes that, in the Architect's sole discretion, it would be inappropriate for the Architect to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Architect may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Architect in rendering a decision. The Architect may request the Contractor to authorize retention of such persons at the Contractor's expense.

§ 15.2.4 If the Architect requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Architect when the response or supporting data will be furnished or (3) advise the Architect that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Architect will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Architect will render an initial decision approving or rejecting the Claim, or indicating that the Architect is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and/ or litigation.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.3 MEDIATION

§ 15.3.2 The parties shall endeavor to resolve their Claims by voluntary mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for voluntary mediation shall be made in writing, delivered to the other party to the Contract.

§ 15.3.3 If the parties voluntarily agree to mediate claims, the parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

NOTE: THESE CONDITIONS SUPERCEDE ANY CONFLICTING CONDITIONS IN THE GENERAL CONDITIONS.

SALES TAX

Itemized sales tax expenditures by the Contractor will be reimbursed to the Owner. BIDS MUST INCLUDE SALES TAX.

DELAYS / CLAIMS

Any contractor whose work is delayed for reasons beyond his control shall immediately notify the Architect as to the nature of the delay, the cause of the delay, and the immediate effect on the project, including cost effects. Verbal notification shall be followed with written notification to the Architect no later than 10 days following the delay; otherwise, no consideration for a claim will be given. For delays claimed by reason of weather, the Contractor shall be required to substantiate such claim by the submission of weather reports for the time period of the delay as well as national weather service reports for the project area for the last ten years, the average of which shall become the basis to determine the validity of such claim. Time extensions granted for reasons of weather or other reasons except as caused by the Owner, with exceptions and time limits for convenience of the Owner as indicated under Section 01011, do not entitle the Contractor to "extended overhead" or "lost profit" recovery.

Delays which do not affect activities on the Critical Path of the approved CPM Construction Schedule will not be considered reason to allow time extensions. Time extensions granted for reasons other than natural weather disasters do not entitle the Contractor to "lost profit" recovery. Time extensions granted for reasons other than natural weather disasters do not entitle the Contractor to "extended overhead" recovery.

CLEAN UP AND PROTECTION OF WORK

The Contractor shall replace any broken glass, remove stains, spots and dirt from decorated work, clean hardware, remove paint spots and smears from all surfaces, clean plumbing fixtures and wash all concrete, and clean and wax resilient tile floors and clean hard tile floors. The Contractor shall be responsible for leaving his work clean in all respects, and shall be responsible for protecting his work from damage by other parties.

CHANGES IN THE WORK

The cost or credit to the Owner resulting from a Change in the work shall be determined as follows:

1. Allowances for overhead and profit combined shall not exceed 15 percent of net cost except when the change involves a Subcontractor, in which case allowances shall not exceed 15 percent for the Subcontractor and 7-1/2 percent for the Prime Contractor.
2. The profit and overhead rates proposed by the Contractor for the initial Change in the Work shall not be changed or modified for the duration of the Contract, and shall apply equally for additive and / or deductive changes.
3. The term "net cost" as used herein shall mean the difference between all proper cost additions and deductions. The "cost" as used herein may include all items of material and labor, the use of power tools and equipment, and such items of cost as Workmen's Compensation Insurance, Social Security and Old Age Benefit, Performance Bond Adjustment and pro-rata charges for foreman. The following items shall be considered as overhead: insurance other than mentioned above, supervision, superintendents, timekeepers, clerks, watchmen, small tools, incidental job burdens and general office expense, and all other items not included in "cost" as above defined.

4. Price requests for changes in the Work furnished to the Architect shall include individual costs for materials, labor, subcontractor work (if applicable), and profit and overhead unless otherwise noted.
5. Unit Prices listed on Bid Form of Proposal, Sitework Material allowances, and Form of Contract shall include all overhead and profit costs. Overhead and profit shall not be listed as a separate or added cost when unit prices and materials allowances are used or credited.

TIME

The Contractor shall fully complete the Work in accordance with the schedule of COMPLETION DATES which are DATES CERTAIN, with no time extensions granted for any reason other than delays caused by the Owner (see below).

WEATHER

Weather is by its nature not "normal", and rain fall varies from year to year. Weather delays are to be accommodated within the schedule as specified, however, "natural disasters", such as caused by severe hurricanes, are excepted. In making his bid, the bidder acknowledges that provisions to accelerate the schedule will be provided as required to meet the scheduled dates, to accommodate abnormal weather conditions, or other delays, except as caused by the Owner.

PROJECT PHASING (note: "Prime" contractor means "sub" contractor under a Single Prime contracting method)

1. The General Contractor is responsible as the project coordinator for all the Prime Contractors. It is the General Contractor's responsibility to schedule the work of all Contractors, to maintain weekly reports to the Architect and the Owner regarding the status of activities of all Contractors, and to submit plans to the Architect and Owner for recovery of any scheduled activity by any Contractor, to the Owner and Architect, for review and immediate implementation.
2. Each Prime Contractor shall be required to coordinate their schedule of activities with the General Contractor, and, in submitting a bid, agree to execute a construction schedule in conformance with the required completion dates. All parts of this schedule will be binding on each Contractor, and it is agreed by all Contractors that liquidated damages will be withheld for any delays caused by them which affect the completion date directly or indirectly, in the sole opinion of the Architect, as further described and defined under the Contract for Construction.
3. All Contractors agree that maintaining the scheduled completion of individual activities is essential for the overall completion of the project schedule, and understand that many activities by other Contractors are dependent on timely completion of their own activities. As such, it is understood and agreed by all Contractors that liquidated damages will be withheld, at the time of delay, for any delays which impact the completion of activities by other Contractors and cause the schedule to be revised to a later completion date. For example, the Sitework Contractor must complete various aspects of sitework in a timely manner to allow the other Prime Contractors to store and stage materials on stoned parking areas, or that finish grading, seeding, mulching, and fertilizing operations shall be completed in a manner which will allow the other Prime Contractors to complete their exterior finish work on time, to provide the project with a completed, full stand of grass on the completion date and not afterwards. As an additional example, General Contractor shall schedule his work and make all provisions to allow the Mechanical Contractor to complete his work in a timely manner to meet his scheduled completion date, which is prior to the General Contractor's completion date, in order for the General Contractor to utilize the HVAC system for conditioning of the building. The foregoing illustrative examples are not intended to imply a listing of issues possible but only to serve as examples.

4. It is understood by all bidders that they will cooperate with each other to formulate and agree on a construction schedule detailing all significant activities of the project within 30 days of award.

COMPLETION DATES (ALL DATES CERTAIN)

The Start Date for the project will be the seventh day following receipt of the Architect's Notice to Proceed.

1. 20 days following start date: All contractors execute approved construction schedule as prepared by the General Contractor.
2. 355 days following start date: Contractor shall receive by this date temporary permits for occupancy from the authorities having jurisdiction over the project, to allow the Owner use of the building.
3. 365 days following start date: Contractor will confirm in writing to the Architect that they have completed the Architect's construction review list. Contractor shall achieve substantial completion and obtained occupancy permits for all areas of the building, to allow the Owner full occupancy of the building. (liquidated damages incurred).
4. 425 days following start date: All construction review items issued by Architect's office shall be final completed (additional liquidated damages incurred).

LIQUIDATED DAMAGES

For each day in excess of the number of days allowed to complete construction under COMPLETION DATES, for each scheduled date, the Contractor shall pay to the Owner the sum of \$1,000.00 as liquidated damages reasonably estimated in advance to cover the costs and/or losses incurred by the Owner by the failure of the Contractor to complete the Work of any Phase indicated in the time specified, such time being in the essence of this Contract and a material consideration thereof. Liquidated damages for days in excess of completion date shall be held as retainage from monthly payments by the Owner, and released from subsequent payments only if delay days are made up and no damages have been incurred by the Owner. The Architect shall be the sole judge as to the division of responsibility between the prime contractors, and shall apportion the amount of liquidated damages to be paid by each of them, according to delay caused by any or all of them. Issuance of a Certificate of Occupancy by any Building Official DOES NOT constitute Substantial Completion or completion of construction under this paragraph. Substantial Completion is defined as suitable for use, in the opinion of the Owner and the Architect.

ADDITIONAL LIQUIDATED DAMAGES

For each day in excess of sixty days beyond the date of Substantial Completion that any corrective or incomplete items remain to be done, for each scheduled date, the Contractor shall pay to the Owner the sum of \$1,000.00 as liquidated damages reasonably estimated in advance to cover the costs and/or losses incurred by the Owner by the failure of the Contractor to complete such corrective work or incomplete items, such time being in the essence of this Contract and a material consideration thereof.

OWNER'S RIGHT TO COMPLETE WORK TO MAINTAIN SCHEDULE

The Contractor agrees that if the Architect determines, at his sole discretion, that the Contractor has repeatedly or persistently failed or refused to implement such measures as will bring the progress of the Work into conformity with the Construction Schedule, then the Owner may contract with others or use the Owner's own forces to perform the Work to bring the progress into conformity with the Construction Schedule. The Contractor agrees that the Owner will be entitled to a set off for the cost thereof including,

but not limited to , actual costs, legal fees, and additional overhead costs, which will be charged against the Contract Sum due the Contractor.

PAY APPLICATIONS AND RETAINAGE

Contractor shall submit Applications for Payments to the Architect monthly for work completed and materials stored ending the twenty-fifth day of the month. Retainage shall be five percent (5%) of monthly estimates. The Architect may, at any time after fifty percent of the work has been completed, if he finds that satisfactory progress is being made and with written consent of Contractor's Surety, recommend to the Owner that retainage be reduced to two and one-half percent (2.5%) of monthly estimates.

Sales tax expenditures shall be substantiated with a certified statement by the Contractor and each of his Subcontractors individually showing total purchases of material from each separate vendor and total sales taxes paid each vendor. Certified statement must have the invoice number or numbers covered and inclusive dates of such invoices.

Materials used from Contractor's or Subcontractor's warehouse stock shall be shown in certified statement at warehouse stock prices and amount of tax paid.

The Contractor shall not be required to certify the Sub-Contractor's statements.

The Contractor and each of his Sub-Contractors shall also show purchases of materials from each separate vendor and the cost of same for which no sales tax has been paid.

When applicable, file a Form E-589CI, Affidavit Of Capital Improvement.

BUILDERS RISK INSURANCE

Contractor shall provide Builder's Risk Insurance, payable to the Contractor and Owner as their interest may appear upon the entire structure and upon all materials in or adjacent thereto which are to be made apart of the insured structure to 100% of the insurable value thereof covering fire, extended coverage, vandalism and Malicious mischief.

END OF SUPPLEMENTARY CONDITIONS

SUMMARY OF WORK

This project involves the furnishing of all labor, materials, and services necessary to complete the construction of the Addition to Thanksgiving Elementary School, Johnston County Schools, North Carolina as shown by the drawings and as specified herein.

PRIORITY OF CONSTRUCTION AND PHASING

Owner shall advise priority of construction based on school operations. Interior work required shall be fully coordinated with owner operations with the understanding that this work will be phased and work areas limited.

NOISE and SCHOOL OPERATIONS

All bidders are to understand that in submitting a bid, they are held to the contract conditions regarding school operations, that the school will be allowed to continue in full operation and that the operation will not be compromised unreasonably, in the opinion of the Edgecombe County Maintenance Director; that noisy operations such as sawing of metal, and screwing through existing building structural members, etc., will be done before or after school is in session. Particular care will be required on days set aside for semester or year-end testing.

Egress from buildings must be maintained at all times. Any temporary work affecting building egress will require approval by district staff and the local AHJ / Fire Marshal.

CONSTRUCTION SCHEDULE

Each Prime Contractor shall coordinate his work with the others to complete his work, on schedule, within the specified time allowed. Within thirty days of award of Contracts to the successful Bidders, the General Contractor will prepare, with the assistance of each Prime Contractor, a Master Construction Schedule, in both bar chart and critical path method form, which shall be signed by each Contractor and become a requirement and part of the Contract Documents.

The Schedule shall include work by Architect and Owner, as may be required by the contractor (i.e. Critical shop drawing review, color selection, inspections, etc.).

The Master Schedule shall be created in electronic computer form using an industry-recognized "Critical Path Method" software program, and continuously maintained for the benefit and use of all Contractors and the Owner/Architect. The General Contractor shall submit to all parties, at each monthly meeting, printed reports, generated from the computer program file, indicating the current status of all project activities, including those of the other Contractors.

CONTRACTS

Contracts will be executed for each Prime Contractor on AIA Document A101, Standard Form of Agreement Between Owner and Contractor, as amended herein.

PAYMENTS

Payments to the Contractor will be made on the basis of ninety-five percent (95%) of monthly estimates approved by the Architect.

Bids shall include North Carolina sales and Use Tax or local sales and use tax. The Owner shall be entitled to reimbursement of taxes paid by Contractor on basis shown separately on monthly request for payment. At the time of delivery of the periodic monthly estimate and request for progress payments, the Contractor shall attach to such requests a statement which shall show the amount of sales tax paid by the Contractor upon purchases of building materials during the period covered by the progress payment request. A sworn statement by the Contractor shall be attached stating that the property upon which such

sales taxes where paid was or will be used in the performance of the contract. Sales tax on purchases or rental of tools and equipment is taxable to the Contractor and shall not be included in the sworn statement. When applicable, file a Form E-589CI, Affidavit Of Capital Improvement. Refer to Section 01011, Supplementary Conditions, for additional requirements.

CONSTRUCTION PROCEDURES

The following Construction Procedures are to be implemented for this project:

1. The General Contractor shall be the Project Coordinator, and as such shall schedule and manage the entire work. Notify the Architect immediately upon any conflict with separate Prime Contractors.
2. The General Contractor shall coordinate with all Prime Contractors to prepare and submit to the Architect within two weeks following the date of the Notice to Proceed his proposed Progress Schedule for completing the Project in the specified time. Include critical shop drawing reviews, inspections, or other work to be scheduled with Architect or Engineer.
3. Approved Schedule shall be distributed to all other Prime Contractors by the General Contractor. Also, post copy in Contractor's field office. General Contractor shall keep other contractors, including his subcontractors, informed of his planned and actual progress, so that the Project Schedule can be maintained.
4. All other prime and sub-contractors shall organize their work to conform to this Schedule and see that all phases of the work progress as smoothly and efficiently as possible.
5. The General Contractor will coordinate the location of tool sheds and storage areas for all contractors within the limits of the site area designated or approved by the Owner.
6. All Contractors shall submit within twenty (20) days from the date of the Notice to Proceed a complete list of all subcontractors and material suppliers (including addresses), that they propose to use on this Project for Architect's and Engineer's approval.
7. All Contractors are requested to furnish the Architect with the name of their project manager, safety manager, and job foreman or superintendent who will be in charge of the work. These men will not be changed during the course of construction without prior notice to the Architect. Furnish Architect and Owner with name and home telephone number of job superintendent and project manager for emergency contact.
8. Architect will hold monthly meetings at the project site on a day and time to be determined. Each Contractor shall have his job superintendent and project manager present, with the major sub-contractors. The purpose of these meetings is to evaluate progress, resolve problems, and in general to help expedite construction. Meeting representatives must have authority to act on behalf of the Contractor.
9. See Specifications, Division 1, General Requirements, for information relative to the following:
 - a. Schedules and Reports
 - b. Samples and Shop Drawings
 - c. LEED Requirements (THIS IS NOT A LEED PROJECT)
 - d. Temporary Facilities and Controls
 - e. Cleaning Up

- f. Project Close Out
10. To expedite handling paperwork, the following procedures shall be used:
- a. Shop drawings and product submittals shall be submitted electronically via e-mail, in non-editable format PDFs. Electronic submittals e-mail subject line will contain the project name, specification number, and product name.
 - b. Each Contractor shall submit to the Architect a cost breakdown of his contract on standard AIA form. Breakdown shall show labor and material. Upon approval by Architect and Engineer, this breakdown shall be used for progress payments.
 - c. Contractor's payment period shall be from the twenty-fifth day of the month to the twenty-fifth day of the following month. Contractor shall forward to the Architect by the first of the following month his Application for Payment in five (5) copies. Owner will make payments by the fifteenth of the month.
 - d. Sales tax expenditures for each pay period shall be substantiated with an attached certified statement by the Contractor and each of his Subcontractors individually showing total purchases of material from each separate vendor and total sales taxes paid each vendor for the applicable period. When applicable, file a Form E-589CI, Affidavit Of Capital Improvement.
 - e. Payment for material stored on site will be approved upon verification of material and quantity. Payment will also be approved if material is stored in a bonded warehouse approved by the Architect and Owner and insured for its full value. Include insurance certificates and certificates verifying storage in bonded warehouse with Application for Payment of such materials.
 - f. Submit copy of Building Permit prior to or with submission of first Pay Application. Payments will be withheld until permit copy is submitted.
11. All materials and submittal data must be approved before Contractor proceeds with installing such items in the Project. All materials requiring color selection shall be submitted together. An incomplete color schedule will not be issued. All material samples must be submitted in order to make a complete, coordinated schedule.
12. Materials and compaction testing company shall be selected by the Owner. The Architect will notify the Contractor of the company and of the specific testing to be done. Based on these instructions, the Contractor will be responsible for notifying the testing company of individual tests to be made.
13. Notify Architect, Structural Engineer, and Testing Laboratory twenty-four (24) hours prior to pouring footings. Pours shall always be the maximum that can be properly handled in a day.
14. Inspection Reports from Architect or Engineers pointing up defective or unacceptable work shall be corrected immediately. Failure to do so will be cause to withhold monthly progress payments.
15. Each Separate Prime Contractor shall be responsible for removing his own waste material and job debris from the all construction areas and the site, fully coordinated with requirements of the Construction Waste Management Plan (CWMP). This shall be done continually. Failure to keep job site clean and safe for maximum working efficiency will be cause to withhold monthly progress payments. Failure to comply with the Construction Waste Management Plan (CWMP) will be cause to withhold monthly progress payments.

16. Construction workers will be properly dressed at all times on the site (shirts, shoes, etc.), and the use of foul language, vulgar or lewd gestures, or any other conduct deemed inappropriate by the Owner will be cause for immediate dismissal.
17. Working Schedule: Working hours shall be coordinated among all Prime Contractors. Advise Owner and Architect.
18. Claims: Follow General Conditions, as amended, for any claims for additional money or time. Claim must be made at time of discovery, time limits in accordance with these Conditions.
19. Final Inspection of Projects: It is the Contractor's responsibility to notify the Architect that the project is complete and to submit a list of discrepancies to be corrected. Following such notification, the Architect shall make a preliminary review of the project to verify completion. From the preliminary review, the Architect shall prepare a punch list of discrepancies for the Contractor. Upon notification by the Contractor that the discrepancies have been rectified, the Architect shall schedule a formal final inspection with the Owner.
20. Record Drawings: One (1) complete set of working drawings will be placed on the job site by the Architect. These drawings will be entrusted to the care of the General Contractor. If any changes or deviations from these drawings are made by any Contractor, such Contractor shall indicate the change on the drawings using colored pencils or ink.
21. Safety Regulations: All Contractors shall abide by current OSHA Regulations at all times. Be advised that the Owner is obligated by these Regulations to report any known violations to OSHA.
22. Smoking is prohibited and not allowed on the construction site property.

DRAWINGS AND SPECIFICATIONS

The following principles shall govern the settlement of disputes which may arise over discrepancies in the contract documents.

1. As between written figures given on drawings and the scale measurements, the figures shall govern.
2. As between large-scale drawings, and small scale drawings, the larger scale drawings shall govern. Discrepancies noted shall be reported to the Architect before commencing work.
3. Where more than one item or procedure is specified or indicated, the Contractor shall provide the item of greatest expense or most stringent procedure.

Titles to divisions and paragraphs in the contract documents are introduced merely for convenience and shall not be taken as a correct or complete segregation of the several units of materials and labor. The Contractor shall see that each subcontractor is familiar with the entire work under this contract to the extent that it affects his portion of the work, as no responsibility is assumed by the Architect for omissions or duplications by the Contractor or his subcontractors due to real or alleged error in arrangement of material in these documents.

The plans and specifications are both a part of this contract and shall be considered cooperative. Any work called for by the plans and not hereinafter specified or vice versa, shall be executed by the Contractor as if specifically mentioned in both.

The drawings and specifications are to be used for this building only and are the property of the Architect; they are to be returned to him before the final certificates are given.

After award of Contract, drawings and specifications shall be obtained and /or downloaded by the General Contractor from the Hite Associates website, www.hiteassoc.com. Additional drawings and / or specifications may be purchased by contacting Speedyblue Reprographics at (252) 758-1616, print@speedyblue.com.

INTENT OF DRAWINGS

In making a Proposal, the Contractor acknowledges that the drawings are diagrammatic in nature, and agrees to provide complete and finished construction assemblies to comply with the Architect's intent and pertinent Building Codes, whether all parts or components of such assemblies are shown or not (for example, doors or frames shown on plan drawings but not scheduled or detailed otherwise shall be furnished, consistent with other doors or frames of type and material as would be reasonably inferable, complete with hardware).

STANDARD OF QUALITY, CONTRACT DEFINITION

The Standard of quality for all work shall be first class in all respects, in the opinion of the Project Architect and Project Engineer. In submitting a Bid, the Contractor agrees to abide by this Standard, and no other. Any work considered less than first class by the Architect/Engineer shall be corrected or removed and replaced as directed.

PROJECT MANAGER AND SUPERINTENDENTS, APPROVAL OF PERSONNEL

The Contractor shall provide resumes of proposed Project Manager and Superintendents to Owner, through Architect, for review and approval prior to assignment. Contractor shall submit only those candidates with a minimum of five years experience in the respective capacities proposed, with projects of similar size and scope.

FIELD SUPERVISION REQUIREMENTS

The Contractor is required to provide a full time Field Superintendent to supervise the work of their Contract and to be present, in the field, and not in a field office, at all times work is being performed by that Contractor or his Subcontractors, for the express purpose of providing continuous control of the quality and correctness of construction. In addition, the Contractor's Field Superintendent is required to provide general supervision and coordination of the work of all other Prime Contractors. This person is required to be equipped with a mobile telephone at all times. The Contractor shall issue daily electronic update reports via e-mail.

FIRE RATED CONSTRUCTION ASSEMBLIES

Where U.L., F.M., W.H.I., or other independent testing agency fire rated construction assemblies are referenced on the drawings, it shall be the Contractor's responsibility to meet the specific requirements of the assembly, as defined by State and Local Building Authorities.

MEASUREMENTS AND DIMENSIONS

Before ordering material or doing work which is dependent for proper size or installation upon coordination with building conditions, the Contractor shall verify all dimensions by taking measurements at the building and shall be responsible for the correctness of same. No consideration will be given to any claim based on differences between the actual dimensions and those indicated on the drawings. Any discrepancies between the drawings and/or the specifications and the existing conditions shall be referred to the Architect for adjustment before any work affected thereby is begun.

SAMPLES AND SHOP DRAWINGS

Each Contractor shall submit such samples of materials and examples of workmanship as are requested by the Architect to show quality and kind of material and work he proposes to deliver or perform in executing his contract.

Shop drawings and product submittals shall be submitted electronically, in non-editable format PDFs, submitted via e-mail. Electronic submittals e-mail subject line will contain the project name, specification number, and product name.

Coordinate LEED submittals with general submittal requirements. Refer to Section 01405 LEED Requirements.

Contractors shall make all submittals promptly after award of contract. Submittals requiring color selection shall be made no later than 60 days after award of contract.

All material requiring color selection shall be submitted for review before any colors are selected. The Contractor shall allow 45 days after all submittals are made for the Owner to make selections, and schedule his submittals accordingly.

OWNER SYSTEM TRAINING SESSIONS

Each Contractor shall have factory trained and certified product representatives provide equipment and system training sessions for the Owner for each product and system. Sufficient training shall be provided to the extent that each Owner attendee is fully versed on the product and/or system and can be a designated "trained" participant, and that each participant can demonstrate the ability to operate each product and system in total variety of operations. Provide multiple training sessions if such is required to be certified as fully trained personnel. An Owner Training Certification is to be provided. Submit an affidavit that each required Owner training session has been performed. Submitted affidavit to include sign-up log of attendees/trainees and description of system or product, cross referenced to the specific contract document.

TEMPORARY FACILITIES

This section covers the furnishing of all appliances, labor, materials, tools, transportation and services required to perform and complete all preliminary work and temporary construction required for the building and site as indicated.

Storage - Each Contractor shall provide such temporary structures as are required for the protection of persons and property. On barricades where necessary, lights shall be maintained at night.

Field Office - General Contractor shall provide and maintain a full time field office construction trailer at the site, equipped with heat, lights, plan desks and telephones. Office shall be sufficient size for use by this Contractor and for on-site meetings with a separate office provided specifically for the Architect's Representatives.

Scaffolds, Tolls, etc. - Each Contractor shall erect and provide all necessary platforms and scaffolds of ample strength required for the handling of materials and equipment such as ladders, horses, poles, planks, ropes, wedges, centers, etc.

Staging: The location of trailers and material storage areas shall be approved by the Architect. Each Prime Contractor will be responsible for repair and testing of the paving base if damaged by his staging activities.

Working Hours: Single or separate prime contractors may set their own working hours, provided, however, that the Project is under supervision by the General Contractor at all times work is being performed.

Sanitation: The General Contractor shall provide and maintain temporary toilets as necessary for use of all workmen. Locate toilets where directed, keep in sanitary condition, and comply with the requirements of the local public health authority.

OSHA

It shall be the responsibility of all contractors to conform to the latest edition of Safety Standards for construction by "OSHA".

CUTTING AND PATCHING

All cutting and patching throughout Project shall be done by the trade requiring the cut. Patching of work or areas affected by cutting, digging and fitting shall be done by mechanics skilled in the applicable trades and shall match surrounding or adjoining similar work. If the quality of the cutting and patching work is not first class and, in the opinion of the Architect, not acceptable, the Contractor will be required to have this work done by the General Contractor, who will be reimbursed for the cost thereof.

CLEANING UP

Each Prime Contractor shall be responsible for keeping the project clean and free of hazardous working conditions. Remove scrap or surplus materials and keep stored materials in a neat and orderly fashion, minimum once weekly.

The General Contractor shall advise all subcontractors and separate prime contractors of their responsibility to keep their part of the project clear and free of accumulated debris.

After completion of Utility Platforms and Main Boiler and Electrical Room construction by all contractors, the General Contractor shall provide a complete vacuuming and wipe down of all mechanical and electrical equipment, including ductwork. The General Contractor shall then provide two coats of clear polyurethane floor sealer as specified to these spaces, after approval of the condition of each space by the Architect.

At the completion of work, the entire project shall be left clean and ready for occupancy. All finished surfaces shall be cleaned, polished, waxed and left in first class condition.

CONSTRUCTION WASTE MANAGEMENT: WASTE AND RECYCLING

The General Contractor shall be responsible for developing and implementing a Construction Waste Management Plan (CWMP) that identifies the materials to be diverted from disposal and their quantities by weight in order to divert a minimum of 75% of all construction and demolition debris. The GC shall submit monthly progress reports indicating quantities disposed and quantities diverted along with each Payment Application. The GC shall also be responsible for providing separate recycling collection containers for disposal and recycling of non hazardous construction and demolition waste. All containers must be clearly labeled with a list of acceptable and unacceptable materials that meet the requirements of the recovery facility or recycling processor, to which the materials shall be hauled. The General Contractor shall provide on site instruction of appropriate separation, handling, and recycling, and return methods to be used by all contractors. These containers shall be maintained on a regular schedule by either the GC or a GC contracted service. If the contracted service provides off-site sorting services, then waste may be commingled on site per the contracted services specifications. If commingling on site is not permitted, then containers are to be provided for the following materials:

1. Concrete waste
2. Brick and CMU (shall be recycled)
3. Wood and Wood Products
4. Cardboard (shall be recycled)
5. Steel and Metals (shall be recycled)

PROJECT CLOSEOUT

Prior to issuance of a Certificate of Final Payment, unless otherwise noted, each Prime Contractor will be required to deliver to the Architect the following items, in non-editable electronic PDF format, indexed with a hyperlinked Table of Contents. All professional seals shall be inked stamps, not embossed. Files to be submitted on an electronic storage device. All warranties requiring signatures for execution, shall be submitted in paper format.

1. Certificate Of Occupancy issued by the jurisdiction having authority.
2. Fully executed final Change Order, reconciling all project allowances.
3. Submit five copies of Final Application for Payment, AIA Documents and Final Sales Tax Report collated and stapled together.
4. AIA Document G 706/Contractors Affidavit of Payment of Debts and Claims, and AIA Document G 706 A/Contractors Affidavit of Release of Liens, properly executed, notarized, with no exceptions.
5. Consent of Surety to Final Payment.
6. Certificate of Compliance. Each Prime Contractor shall furnish the Architect a certificate, duly notarized, stating that he has constructed his part of the work of the project in complete compliance with the Drawings and Specifications.
7. Each Prime Contractor shall furnish to the Owner through the Architect a certificate, duly notarized, stating that "no hazardous materials, including lead, asbestos, or PCBs, have been used in the work of the Contract".
8. Each Prime Contractor shall furnish to the Owner through the Architect in triplicate, duly notarized, an unconditional Warranty to guarantee his work free from defects in materials and workmanship for a period of one year following Substantial Completion.
9. Operations and Maintenance Manuals indexed, shall be submitted in electronic format with items and sections hyperlinked to the O&M's Table of Contents. Provide paper copies of product warranties.
10. As-Built drawings. Each prime contractor shall deliver to Architect one complete set of as-built drawings. Changes in the work shall be marked in red on a new set of drawings.
11. Transmittal of keys to Principal, acknowledgement signed by Principal, and Finish Hardware Bidding List.
12. Final Color Finishes Schedule.
13. Owner Training Certification: Submit affidavit that each required Owner training session has been performed. Submitted affidavit to include sign-up log of attendees and description of system or product cross referenced to the specific contract document.
14. Process and deliver to the Architect all product guarantees and warranties, materials and testing certificates, etc., as required by various sections within these specifications and by various agencies having jurisdiction over the Work, indexed.

Do not make separate submittals of the above. Incomplete submittals will be returned to the Contractor.

Division 1: GENERAL REQUIREMENTS

Section 01040 – General Requirements and Construction Schedule

- A. Final List of Material Suppliers and Subcontractors with all changes incorporated, (names, addresses, phone numbers, emergency phone numbers)
- B. Final Color Schedule

Section 01050 - Special Conditions for Utilities Construction

- A. Record Drawings of Utilities construction
- B. Copy of all easements with documentation of recording with Register Of Deeds
- C. Sewer system extension work certification by Professional Engineer
- D. Water system extension work certification by Professional Engineer

Division 2: SITE WORK

Section 02281 – Termite Control

- A. 5 year termite control warranty

Section 02713 – Water Mains

- A. Sealed and signed Record Drawings of water mains final installation
- B. Water mains chlorination and bacteriological test results/certifications

Section 02730 – Gravity Sanitary Sewer System

- A. Visual Inspection Certification
- B. Leakage Testing Inspection Certification
- C. Mandrel Deflection Testing Certification
- D. Manhole Testing Certification

Section 02730 – Gravity Sanitary Sewer System

- A. Force Main Testing Certifications

Division 7: THERMAL AND MOISTURE PROTECTION

Section 07218 – Sprayed-On Acoustical Insulation

- A. Manufacturer's asbestos free material certification

Section 07610 – Metal Roofing

- A. Contractor's 20-year weather tightness warranty
- B. Manufacturer's 20-year perforation warranty
- C. Manufacturer's 20-year paint film warranty
- D. Independent third party inspection report
- E. Independent third party inspector's qualifications certificate

Section 07900 – Joint Sealers

- A. 3-year guarantee, workmanship, materials, airtightness, watertightness

Division 8: DOORS AND WINDOWS

Section 08200 – Wood Doors

- A. Manufacturer's lifetime guarantee

Section 08210 – FRP Doors and Frames

- A. Manufacturer, contractor and installer's 10-year material and workmanship guarantee
- B. Affidavit for delivery of adjustment tools and instruction sheets.
- C. Affidavit for in-service session with Owner
- D. One year labor warranty for in-service, adjustment tools and instruction sheets

Section 08410 – Aluminum Swing Entrances

- A. Manufacturer's and installer warranty
- B. Project record documents
- C. Operations and maintenance data on installed materials
- D. Manufacturer's statement of available Field Services upon request

Section 08418 – Aluminum Storefront Systems

- A. Project record documents
- B. Manufacturer's 5-year warranty
- C. Manufacturer's statement of available Field Services upon request

Section 08500 – Aluminum Windows

- A. Manufacturer's warranty; 2-year window, 5-year glass, 1-year defects

Section 08700 – Finish Hardware

- A. Affidavit for delivery of tools, instructions and maintenance information.
- B. Two copies of Job Use Finish Hardware Schedule

- C. Affidavit certifying in-service sessions performed with Owner
- D. Affidavit certifying dated appointments with Owner for 6-month Service and Report field visit.

Section 08800 –Glass and Glazing

- A. 5-year glass leakage and seal guarantee
- B. One year replacement warranty

Division 9: FINISHES

Section 09300 – Tile

- A. Affidavit certifying specified extra stock was accepted by the Owner

Section 09510 – Acoustical Ceilings

- A. Manufacturer's 15-year humidity no-sag warranty
- B. Affidavit certifying specified extra stock was accepted by the Owner

Section 09624 – Elastic Vinyl Gymnasium Flooring

- A. Manufacturer's maintenance instructions
- B. Manufacturer's 15-year wear warranty
- C. 2-year workmanship and defects warranty
- D. Affidavit certifying dated appointments with Owner for 1-month Inspection prior to warranty expiration
- E. Manufacturer/supplier/installer maintenance instructions demonstration

Section 09650 – Resilient Flooring

- A. Maintenance manuals
- B. Affidavit certifying specified extra stock was accepted by the Owner

Section 09656 - Resilient Terrazzo Tile

- A. Manufacturer's maintenance manuals
- B. 20-year wear warranty
- C. 20-year workmanship and defective material warranty
- D. Affidavit certifying specified extra stock was accepted by the Owner

Section 09780 – Carpeting

- A. Lifetime workmanship and material guarantee

Division 10: SPECIALTIES

Section 10100 – Markerboards, Chalkboards and Tackboards

- A. Lifetime material warranty

Section 10536 – Awnings and Awning Frames

- A. 5-year loss of strength or color material warranty

Section 10615 – Demountable Gypsum Panel partitions

- A. Contractor agreement to maintain renovations and additions materials
- B. Manufacturer's one year standard warranty

Section 10655 - Folding partitions

- A. Manufacturer's one year materials and workmanship warranty
- B. Affidavit certifying Owner's demonstrations and training performed
- C. Maintenance manuals

Division 11: EQUIPMENT

Section 11200 - Kitchen Equipment

- A. Affidavit certifying manufacturer's In-Service sessions for all kitchen equipment performed and completed with Owner
- B. One year parts and labor warranty
- C. Operations and maintenance manuals

Section 11450 – Residential Kitchen Equipment

- A. Manufacturer's standard warranty

Section 11780 – Video Monitor Mounting Equipment

- A. Mounting bracket 5-year workmanship and materials warranty

Division 12: FURNISHINGS

Section 12110 – Library and Admin Area Furnishings

- A. Bidders one year workmanship and materials warranty

Division 13: SPECIAL CONSTRUCTION

Section 13900 – Fire Protection – Wet Pipe System

- A. Bidders one year workmanship and materials warranty

Division 15: MECHANICAL

Section 15000 - General Provisions for Plumbing and HVAC

- A. Bidders one year workmanship and materials warranty

Section 15170 - Motors

- A. Commissioning Inspection for vibration, noise, unusual conditions.

Division 15A: PLUMBING

Section 15200 - Water Supply Systems

- A. Cleaning, primer painted
- B. Chlorination, County Health Dept Approval
- C. Pressure Testing
- D. Verification of proper operation of heat tape
- E. Pipe and Valve Identification

Section 15250 - DWV Piping Systems

- A. Pressure Testing
- B. Video Tape Entire Sanitary Sewer System, with Engineer and Owner representative on site.

Section 15260 - Kitchen Sanitary DWV

- A. Pressure Testing
- B. Video Tape Entire Sanitary Sewer System, with Engineer and Owner representative on site.

Section 15400 - Plumbing Fixtures

- A. Commissioning, adjusting, cleaning, sealing
- B. Set minimum 6" stream at all EWC.

Section 15430 - Domestic Water Heaters

- C. Set T-stats, coordinate EMS control with MC.

Division 15B: HEATING, VENTILATION & AIR CONDITIONING

Section 15500 - Mechanical Insulation

- A. Commissioning
- B. One year from startup not to exceed 24 months, workmanship and materials warranty

Section 15550 - Boilers & Associated Equipment

- A. Boiler Certificate of Inspection – NC Department of Labor
- B. Commissioning
- C. One year from startup not to exceed 24 months, workmanship and materials warranty

Section 15630 - Split System Heat Pumps

- A. One year workmanship and materials warranty, Five year non-prorated compressor warranty
- B. Provide one year supply of 2" disposable filters

Section 15635 - Split System A/C Units

- A. One year workmanship and materials warranty, Five year non-prorated compressor warranty

Section 15682 - Air-Cooled Rotary Liquid Chiller

- A. Operation and Maintenance manuals, including startup instructions
- B. Two days factory trained representative to supervise testing, start-up and instruction on operation and maintenance to owner.
- C. Provide commissioning Report as outline in specifications.
- D. Furnish service and maintenance of the complete assembly for one year from Date of Substantial Completion.
- E. Bidders two year parts and labor, five year warranty on motors, transmission, compressor, not to exceed 72 months from shipping date.

- Section 15730 - Refrigeration Piping System
 - A. Testing, 1½ maximum operating pressure for 24 hours
- Section 15735 - Condensate Piping System
 - A. Testing fill all condensate pans and allow to drain verify no leaks are in the system.
- Section 15740 - Hydronic Piping Systems
 - A. Provide welder's certification
 - B. Identification
- Section 15745 - Water Treatment Systems
 - A. Retest water system prior to 11 month warranty inspection. Make required corrections and submit to report to Architect.
- Section 15750 - Pumps & Hydronic Accessories
 - A. Commissioning
 - B. One day startup and training on operations and maintenance for owner.
 - C. Bidders one year workmanship and materials warranty, not to exceed eighteen months from shipping to the job site.
- Section 15800 - Air Distribution and Accessories
 - A. Clean Duct System per Section
- Section 15955 - Energy Management System
 - A. Commissioning report
 - B. Training
 - C. Additional training for next four years per section.
 - D. Bidders one year workmanship, labor and materials warranty
 - E. Two year warranty on all DDC controllers, valves, and actuators
 - F. 16 hours of on-site adjustment 9 months after Date of substantial completion.
- Section 15963 - Control Valves and Actuator Systems
 - A. Commissioning
 - B. Bidders two year unconditional warranty
- Section 15966 - Pump Systems Control
 - A. Demonstration per section
 - B. Training per section
 - C. Bidders one year workmanship and materials warranty
- Section 15975 - Electrical Work
 - A. Bidders one year workmanship and materials warranty
- Section 15980 - Testing & Balancing Procedure
 - A. Perform and report activities per section
- Section 15990 - Systems Commissioning
 - A. Maintenance and operations manuals
 - B. Wiring diagrams
 - C. Warranties
 - D. Contact phone numbers and personnel
 - E. Parts Lists
 - F. Instruction and training

Division 16: ELECTRICAL

- Section 16400 – Service and Distribution
 - A. Provide Equipment Identification
- Section 16804 – Fire Alarm
 - A. Test per section
 - B. Instruction as required for operating the system per section
 - C. Installers Certificate
 - D. Bidders one year workmanship and materials warranty
- Section 16900 – Tests and Project Closeout
 - A. Testing per section, include ground resistance tests.
 - B. Two complete sets of as-builts
 - C. Operating and maintenance manuals
 - D. Bidders one year workmanship and materials warranty

Division 17: INTEGRATED TECHNOLOGY SYSTEMS

Section 17000 - General Provisions

- A. Provide copies of applicable licenses and permits.

Section 17100 - Integrated Communications Systems

- A. Three Copies of operations and maintenance manuals, as built drawings, Single line diagrams.
- B. Acceptance testing and test reports.
- C. Bidders one year workmanship and materials warranty
- D. 120 hours training, refer to section for requirements.
- E. Factory Certification for 3 Craven County Employees, see section for details, include all required access to reprogramming and customizing system applications to the owner, this includes all licenses, access codes, etc.

Section 17200 - Data Cabling Systems

- A. Testing, reports, commissioning testing
- B. Three sets of Operations and maintenance manuals, as built drawings, single line diagrams.

Section 17300 - Broadband CATV

- A. Testing and reports
- B. Bidders one year workmanship and materials warranty
- C. Two days training, refer to section for requirements.

Section 17400 – Security System

- A. Testing
- B. Bidders one year workmanship and materials warranty
- C. Two days training, refer to section for requirements.

Section 17900 - Tests, Commissioning and Project Closeout

- A. Testing and reports
- B. Bidders one year workmanship and materials warranty except where noted otherwise.
- C. Two notebook sets of instructions, operating and test procedures and parts list.
- D. Two days training, refer to section for requirements.

Do not make separate submittals of the above. Incomplete submittals will be returned to the Contractor.

END OF SECTION

1. **CONFLICT OF GRADE:** It is intended that the water mains be installed with a minimum of 36"inch cover, but the contractor is notified that he will be required to install the water mains with more than 36 inch cover as required in order to avoid conflicts.
2. **THRUST RESTRAINT:** Concrete blocking shall be installed as required at all tees, bends, etc., for all pipes unless otherwise directed. No separate payment shall be made for thrust restraint.
3. **CONNECTION TO COUNTY OF JOHNSTON OWNED FACILITIES:** No connection to or alteration (including operation of valves, hydrants, etc.) of the County of Johnston's facilities shall be performed without the County of Johnston's specific approval. All pipe, valves, taps, fittings, etc. which could possibly contaminate the County of Johnston's facilities shall be thoroughly disinfected prior to their use. Excavations for such connections shall be kept completely dewatered and the utmost care exercised to avoid contamination of County of Johnston owned facilities.
4. **SALVAGE OF COUNTY OF JOHNSTON OWNED FACILITIES:** When project work results in removal of County of Johnston owned facilities and equipment, the Contractor shall be required to deliver those facilities or equipment undamaged to the County of Johnston's Operation Center, if requested to do so by County of Johnston.
5. **NOTIFYING UTILITIES COMPANIES:**
 - 5.1 In accordance with the Underground Damage Prevention Act, the Contractor shall, within a time frame of not less than 2 or no more than 10 working days prior to the start of any excavation within any public right of way or private easement areas owned by a utility company, notify each utility owner having underground utilities in the area to be excavated of the following information:
 1. Name, address, and telephone number of the person serving the notice.
 2. Name, address, and telephone number of the company that will be performing the excavation.
 3. Anticipated starting date of the excavation and duration.
 4. Type of excavation to be conducted.
 5. Location of excavation.
 6. Whether or not explosives will be used.
 7. Contractor shall notify NC One Call, Greensboro, N.C. at least 48 hours prior to commencing construction in order that existing utilities in the area may be flagged or staked. The toll-free number is 1-800-632-4949. This service will in no way relieve Contractor of his responsibility to protect and maintain all existing utilities in an operational manner. Utilities location by NC One Call is not valid after the expiration of a 10 day period beginning on the date of such location.
- 5.2 **Responsibilities during Construction:** In addition to serving notice of intent to perform excavation, the Contractor shall:
 1. Plan the excavation to avoid damage and to minimize interference with underground utilities in and near the construction area to the best of his abilities;
 2. Maintain a clearance between an underground utility and the cutting edge or point of any mechanized equipment, taking into account the known limit of control of that cutting edge or point, as is reasonably required to avoid damage; and
 3. Provide support for the underground utilities in or near the construction area, including backfill, as may be reasonably required by the utility owner for the protection of the underground utilities.
 4. When excavation by the Contractor results in known damage to an underground utility, the Owner of the utility shall be notified immediately and the utility given a reasonable time in which to repair the damage before the Contractor proceeds with excavation in the immediate area of the damage.

- 5.3 **Responsibility of Utility:** Once notified, each utility must, prior to the day designated by the Contractor as the anticipated start date, provide the Contractor with the following information:
1. The location of the utility;
 2. The location and description of all utility markers;
 3. Any other information that would assist in locating the utility, including temporary markers when necessary.
- 5.4 **Failure to Respond:** If the utility fails to respond to the Contractor's notice or fails to properly locate its underground utilities, the Contractor is free to proceed with excavation. Neither the Contractor nor Owner is liable for damage to utilities if the Contractor exercises due care.
6. **CONSTRUCTION STAKE-OUT:**
The construction staking shall be performed by a Registered land Surveyor at least twenty-four (24) hours and three hundred feet (300') in advance of construction and shall identify the party responsible for payment for same.
- The staking will include waterline, valves and fire hydrant stakeout; sanitary sewer stakeout; water and sewer services; rough grade staking; curb and gutter staking; storm drainage structure staking.
7. **TRAFFIC CONTROL:** The Contractor shall be responsible for maintaining an approved traffic control plan during the course of this work. The traffic control plan implemented for this project shall be devised through a joint effort of the NCDOT and the Contractor immediately prior to construction. In all instances, however, the Contractor shall be required to furnish, place, and maintain all signs, barricades, cones, and other traffic handling devices necessary to implement the traffic control plan.
8. **PROJECT SCHEDULE:** The Contractor shall be required to furnish an anticipated schedule of work at the time of the pre-construction conference. In addition, the Contractor shall be required to furnish bi- weekly updates of the schedule of work.
9. **FINAL CLEAN-UP:** The Contractor shall clear all streets, curbs, gutters, driveways and other contract items of all dirt and debris before final inspection will be made. The Owner will not inspect the improved area until they are cleaned.
10. **USE OF A PORTION OF THE WORK:** Whenever, in the opinion of the Engineer, any portion of the work is completed, or is in an acceptable condition for use, it shall be used for the purpose intended. Such use shall not be held in any way as an acceptance of that portion of the work used, or as a waiver of any of the provisions of these specifications. Necessary repairs or renewals in any section of the work due to defective materials, defective workmanship, or natural causes, under the instructions of the Engineer shall be performed by the Contractor at no additional cost to the Owner.
11. **SPECIAL AREAS:** Special access to construction other than existing easements or rights-of-ways shall be the responsibility of the Contractor and he shall be liable for all special agreements.
12. **MOBILIZATION:** Shall be accomplished in accordance with Section 800 of the N.C. State Highway Specifications for Roads and Structures except that there will be no compensation for mobilization as a line item.
13. **TEMPORARY TOILETS:** Provide temporary toilet facilities for use of all workmen. Insure temporary toilet facilities comply with local and State sanitation laws and regulations. Use of existing facilities by Contractor is not permitted.

14. **DRAWINGS SHOWING CHANGES DURING CONSTRUCTION:** The Contractor shall maintain a set of plans and specifications marked "Construction Record Drawings". The Contractor shall keep a complete and up-to-date record in red pencil of any and all changes made during construction. This set of Contract Documents shall be submitted to the Engineer and approved by him prior to the Engineer recommending final payment.
15. **PRECONSTRUCTION CONFERENCE:** Conference shall be held in the County of Johnston at a designated place, after acceptance of proposals. Engineer will notify Contractor of time and date of meeting.
- Prior to commencing any water or sewer extension construction work, the Department Engineer shall be contacted to schedule a preconstruction conference. No construction shall occur until after the preconstruction conference is held.
16. **WORK IN NORTH CAROLINA RIGHT-OF-WAY:** A bond shall be posted with the State of North Carolina for ten percent (10%) of the cost of construction within the right-of-way. This bond shall be posted prior to commencement of work.
17. **NORMAL WORK HOURS:** Unless special written consent is issued by the County of Johnston, all construction shall be performed during the regular office hours of the County of Johnston, i.e. 8:00 a.m. to 5:00 p.m. After hours, holiday, or weekend work should include only such tasks that do not require observation by the County of Johnston's Representative. Under certain conditions, the County of Johnston may agree to provide construction observation after hours or on weekends and holidays. The Contractor shall bear the costs of provision of such construction observation.
18. **OPERATION OF EXISTING FACILITIES:**
1. The Contractor performing water or sewer extension work shall contact the Department Engineer whenever operation of the County of Johnston's valves or hydrants is necessary to request scheduling of such operation. The County of Johnston shall require the Contractor to estimate the length of time service will be interrupted and the number of customers to be affected.
 2. Facilities and equipment belonging to the County of Johnston may not be operated or adjusted without the express permission of the County of Johnston's Representative. In the case of any emergency, the Contractor shall be allowed to take such steps with valves and hydrants as necessary for the protection of life and property.
 3. Valves which control networks not yet accepted but which are connected to the existing system shall be considered system valves. Valves within a network not yet accepted and which do not control the flow of water between new and existing systems are not considered system valves and do not require permission to operate.
 4. Notification to the County of Johnston must be made by the Contractor upon breakage of any County of Johnston maintained water or sewer line or appurtenance thereof. Repair of the County of Johnston's facilities shall be made by the Contractor upon approval of the Department Engineer. Any repairs made with County of Johnston forces will be billed to the contractor at cost.
 5. Where interruption of service is required, the County of Johnston shall be notified to request approval and subsequent scheduling of such interruption. The County of Johnston shall notify the affected customers should the interruption be approved.
19. **Project Close-out:**
- A.. Pre-final Inspection: upon the completion of construction, the Contractor or Developer shall contact the County of Johnston to schedule a pre-final inspection. A pre-final inspection will not be scheduled until the following requirements are met:

- a. The work shall be in accordance with the requirements of the County of Johnston.
- b. A copy of the final estimate has been submitted and approved by the County of Johnston.
- c. The easements and dedicated property required for the work by this Manual have been obtained and are recorded at the Register of Deeds.
- d. The As- built drawings for the work have received the approval of the Department Engineer.
- e. All fees applicable to the project have been received by the County of Johnston.
- f. When a project includes sewer system extension(s), the County of Johnston has received certification by a Professional Engineer stating that the sewer system installation conforms with the requirements of the approved Contract Documents as required by Section .0219 of the DEHNR regulations (G.S. 143-215.1).
- g. When a project includes water system extension(s), the County of Johnston has received certification by a Professional Engineer stating that the water system installation conforms with the requirements of the approved Contract Documents as required by Section .0903 of the NCDHS regulations (G.S. 130A-315; 130A-317).

At the scheduled pre-final inspection, the Department Engineer shall perform a visual inspection in the presence of the representatives of the Contractor and the Engineer. The Engineer or his representative shall prepare a detailed punch list of any deficiencies discovered and provide copies to the Developer, Contractor, and the County of Johnston. Any defective items noted shall be corrected prior to acceptance.

B. Final Inspection: upon completion of the items on the punch list, the Contractor or Developer shall contact the County of Johnston to schedule the final inspection. Any remaining defective items shall be noted and corrected prior to acceptance. No service shall be provided prior to project acceptance.

*****END OF SECTION*****

GENERAL

The Base Bid constitutes the primary choice of the Owner with respect to the pertinent specifications for construction, materials, equipment and supplies. The Owner reserves the right to accept or reject any or all Alternates, in any combination with the Base Bid, in accordance with the general provisions of the Contract for Construction.

See Form of Proposal for complete description of Alternates.

END OF SECTION

GENERAL

CASH ALLOWANCES:

The Contractor shall include a CASH ALLOWANCE in his bid of \$200,000 to include labor, tax, and freight. The Owner reserves the right to bid the work or select subcontractors, and to credit the balance of the allowance at the completion of the Contract. Unit Prices listed on Bid Form of Proposal, Sitework Material allowances, and Form of Contract include all costs, including overhead and profit costs, and shall not be listed as a separate cost when unit prices and materials allowance materials are used or credited.

The work and items covered in the CASH ALLOWANCE are indicated in the plans and specifications, and include:

- Testing and Special Inspections
- Expansion of BDA Emergency Responders Radio Coverage system, testing and equipment as required
- Project sign and permanent inside signage
- Video monitors systems with hardware and brackets
- Other items or work directed by the Owner

Equipment or items which are specified and not noted to be a part of an ALLOWANCE are to be priced and included in bid separately.

BUILDING PERMITS and all other permit costs shall be determined by Bidders and provided for in Bids.

MATERIAL ALLOWANCES:

1. Mass undercut for building pads and pavement areas: General Contractor shall provide in his bid 100 cubic yards of mass undercut, disposal off site, and select or structural off-site borrow backfill, compacted in place, as directed by the Geotechnical Engineer. Specified stripping of site as indicated in Geotechnical Report and fill as indicated by finished construction grades is NOT a part of this allowance. Geotechnical Report recommendations for removal of wood/rootmat material subgrade layers, as a component of stripping and site clearing operations, is NOT a part of this allowance.
2. Foundation undercut: General Contractor shall provide in his bid 20 cubic yards of localized undercut installed for building foundations and floor slabs, disposal off site, with backfill of #57 or #67 washed stone, in addition to the specific requirements on the Structural Plans.

NOTE: THESE MATERIAL ALLOWANCES WILL BE MEASURED AND MONITORED BY THE OWNER'S TESTING AGENCY. AMOUNTS NOT USED WILL BE CREDITED BACK TO THE OWNER AT THE UNIT PRICE INDICATED ON FORM OF PROPOSAL. AMOUNTS USED IN EXCESS OF THESE ALLOWANCES WILL BE CHARGED TO THE OWNER AT THE SAME UNIT PRICES.

END OF SECTION

The recommendations of the Geotechnical Subsurface Report shall are the requirements of the Work, AS MODIFIED HEREIN.

All bidders are advised to carefully review the soil conditions of the project site and the site itself, and shall take into account in their bid, conditions that will require weatherproofing of the building pad or areas outside the building pad, with stone or other materials to allow construction to continue in wet weather, and to provide off site select backfill for trenches where natural soils may not reach specified compaction.

GEOTECHNICAL ENGINEERING REPORT



JCS – ARCHER AREA ELEMENTARY SELMA, NORTH CAROLINA

PREPARED FOR:

HITE ASSOCIATES, P.C.
2600 Meridian Drive
Greenville, NC 27834

NOVA Project Number: 10727-2019022

October 23, 2019



PROFESSIONAL | PRACTICAL | PROVEN



October 23, 2019

HITE ASSOCIATES, P.C.
2600 Meridian Drive
Greenville, NC 27834

Attention: Mr. Jimmy Hite, AIA, LEED, AP

Subject: Geotechnical Engineering Report
JOHNSTON COUNTY PUBLIC SCHOOLS
ARCHER AREA ELEMENTARY SCHOOL SITE
Selma, Johnston County, North Carolina
NOVA Project Number 10727-2019022

Dear Mr. Hite,

NOVA Engineering and Environmental, Inc. (NOVA) appreciates the opportunity to submit this Geotechnical Engineering Report for the above referenced project. Our services have been performed in general accordance with our Professional Services Agreement and Proposal No. 027-20190443 dated May 29, 2019 as well as our Additional Services Agreement dated October 2, 2019. This report provides the results of our field and laboratory testing programs and provides geotechnical engineering recommendations relative to the proposed site development.

We appreciate the opportunity to be of service on this project. Please feel free to contact us with any questions in the meantime.

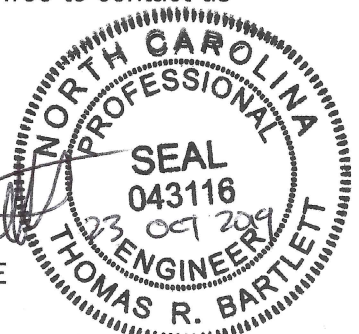
Sincerely,

NOVA ENGINEERING AND ENVIRONMENTAL, INC.

Garrett Stancil, EI
Project Manager

Thomas R. Bartlett, PE
Branch Manager

North Carolina Registration No. 043116



Reviewed By: Kenneth Houseman, PE; Executive Vice President

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ATTACHMENTS

Figure 1	Site Location Plan
Figure 2	Boring Location Plan
Figure 3	Shear Wave Velocity Profiles
Figures 4 through 17	Logs of Borings B-1 through B-14
Figures 18 through 28	Logs of Borings P-1 through P-33
Figures 29 and 30	Liquid and Plastic Limits Test Report
Figures 31 and 32	Important Information About Your Geotechnical Engineering Report

1.0 SUMMARY

A brief summary of our findings and recommendations are presented below. This information should not be utilized without reading the report in its entirety.

- The approximately 39-acre site will be developed with an approximately 95,000 square foot one-story elementary school, with associated paved parking and drive areas. A grading plan was not available at this time.
- The native, near-surface materials encountered in the borings typically contained mixtures of silt and clay and were found to have moderate to high plasticity. Despite their current stiffness, these materials are moisture sensitive and will degrade with exposure to moisture. To the extent practical, construction should be performed during warmer, drier periods of weather.
- A second soil stratum consisting of low plasticity silt, sandy silt and silty sand was typically encountered below the silt/clay soil layer. These materials were found to be medium stiff to very stiff as well.
- Within our borings, groundwater was encountered at depths as shallow as 15.5 feet below current grades. Dewatering will be required where groundwater is encountered in excavations.
- Soils with a liquid limit of more than 60 and a plasticity index of more than 30 will not be suitable within 2 feet of subgrade elevations for foundations and pavements. We expect isolated pockets of these materials may be encountered during mass grading.
- In our opinion, the site will be suitable for support of the proposed structure on shallow foundations. Additionally, we expect the site to be suitable for support of the proposed floor slabs and pavements. Additional testing should be performed at the time of construction as described in this report.
- We performed geophysical testing at two locations to determine the shear wave velocity profile of the subsurface materials through a depth of at least 100 feet below the surface. The shear wave velocity within the upper 100 feet of the subsurface profile is consistent with the characteristics of Seismic Site Class D as defined by the 2015 International Building Code (IBC).
- We recommend that subsequent to a site grading plan being completed, and traffic loadings are provided, NOVA be provided an opportunity to review our recommendations, and assist in evaluation of on-site soil use during the development of this project site.

2.0 SITE & PROJECT INFORMATION

The proposed elementary school and associated facilities are to be constructed at a site located at 1125 Lynch Road, about 0.25 miles north of NC Hwy 42, in Selma, Johnston County, North Carolina. The site consists of one parcel totaling approximately 39 acres. Reference the attached Site Location Plan for further details regarding the site location. A majority of the site was previously wooded and has recently been logged. Approximately 10 acres of the site has been previously cultivated and used for agricultural crops. The site typically slopes downwards from the crest of a

hill in the northeastern part of the site towards a series of creeks and tributaries that extend through the northern and western parts of the site.

We understand that planned improvements to the property include a 95,000 square foot one-story elementary school, with associated paved parking and drive areas. We expect the building will consist of a single-story metal-framed structure with a concrete slab-on-grade. Typical maximum column loads are anticipated to be 75 kips while maximum wall loads are expected to be less than 4 klf. The new elementary school will be laid out in a “star” pattern with a central main building and 4 wings.

If any of the above presented information is inaccurate, or if the design changes, we request the opportunity to revise our recommendations. Please note that a grading plan was not available at the time of this evaluation.

3.0 FIELD & LABORATORY TESTING PROCEDURES

3.1 FIELD TESTING LOCATIONS

Field testing locations were established in the field using cell phone grade GPS which is horizontally accurate to about 10 feet. The field sampling locations are indicated in the attached Figures 2 and 3. We performed clearing with a track mounted excavator to facilitate access for the drill rig.

3.2 SOIL TEST BORINGS

We performed 25 soil test borings at the project site to depths of approximately 10 to 25 feet below the ground surface. The soil test borings were advanced with ATV-mounted rotary drill rig using 2-1/4 inch hollow stem augers. Within the soil test borings, we performed the Standard Penetration Test (SPT) in general accordance with ASTM D1586. Four samples were obtained from SPT tests in the top 10 feet of each boring with testing/sampling at 5-ft intervals thereafter. The SPT “N-value” is reported on the individual boring logs and provides an empirical indication of soil strength. The N-value is determined by the cumulative number of blows required by a 140-lb. hammer, operating freely over a 30-inch drop, to advance a 2-inch O.D. split-barrel sampler from 6- to 18-inches of the typical overall penetration of 18-inches. After advancing the sampler, the soil sample is retrieved and cataloged for further analysis in the laboratory.

3.3 LABORATORY TESTING

We evaluated the soil samples that were collected in the field in our laboratory using visual-manual procedures (ASTM D2488). Select samples were also tested for natural moisture content and Atterberg limits. The results of moisture content testing are reported on the attached boring logs. The results of Atterberg limits testing are reported on the boring logs

and in the attached Figures 29 and 30.

3.4 GEOPHYSICAL TESTING

The site was explored by means of 2 Refraction Microtremor geophysical tests to assess the general consistency of the subsurface strata to a depth of 100 feet below grades. These tests were conducted in the vicinity of the proposed central school building structure. For each of these tests, 12 geophones were placed on the ground surface and vibrations from passing traffic were recorded. Geophone spacing for both Line 1 and Line 2 was 33 feet. The obtained data was downloaded and interpreted by the Vspect Computer Program to assess the shear wave velocity profile for each line. The results of these two tests are attached.

4.0 SUBSURFACE CONDITIONS

4.1 SITE GEOLOGY

Geologically, the site is located near the boundary of the Piedmont and the Coastal Plain Physiographic Provinces. The residual soils of the Piedmont are generally derived from the weathering of the underlying ancient igneous and metamorphic bedrock while the Coastal Plain soils consist mainly of marine sediments that were deposited during successive periods of fluctuating sea level and moving shoreline. Sites along the border of the Piedmont and Coastal Plain typically exhibit a layer of alluvial deposits ranging from very thin to tens of feet thick, overlying the residual materials and bedrock below. According to the *1985 Geologic Map of North Carolina*, the site is mapped within the Terrace Deposits formation which contains, clayey sand and sand. Based on the Piedmont formations that are mapped in areas adjacent to the site, bedrock consisting of Boitite Gneiss and Schist likely underly the Terrace Deposits.

4.2 SUBSURFACE MATERIALS

The following sections of this report provide a generalized description of the subsurface strata encountered at the boring locations. Detailed descriptions of the encountered subsurface materials are indicated on the individual boring logs in the Appendix.

4.2.1 Surface Materials

Typically we encountered 2 to 5 inches of topsoil in the borings performed at the site. However, in several borings, we encountered approximately 10 inches of topsoil.

4.2.2 Cultivated Zone

Within the borings performed in the cultivated area, an approximately 10-inch thick plow zone was encountered with native soils being soft and loose.

4.2.3 Firm Near Surface Deposits

Beneath the topsoil and plow zone, we encountered interbedded deposits of silt, sand, and/or clay in various proportions through depths of 10 to 12 feet bgs. These materials meet USCS classifications of CL, CH, ML, MH, SC, and SM. Moist. The consistency of these materials generally ranged from medium stiff to very stiff while the relative density was generally found to be medium dense to dense.

4.2.4 Less Firm Deposits

Below a depth of 10 to 12 feet, we encountered interbedded deposits of soils that classify in the USCS system as CL, ML, SC, SM, SC-SM, and SP. Generally, the materials encountered within this stratum were found to be wet and less firm than the near surface soil stratum. Based on the SPT N-values, the consistency of these materials generally ranged from soft to medium stiff while the relative density was generally found to be very loose to loose. However, the low SPT N-values in the sandier soils encountered below the water table are likely attributable to error introduced by hollow stem auger boring in these conditions rather than actual very loose conditions. An example of this is the SPT N-value of 4 obtained for SS-7 in Boring No. B-1.

4.3 GROUNDWATER CONDITIONS

1 open boreholes were checked after auger removal for the presence and level of groundwater. The depths where groundwater was encountered are identified in the table below.

Boring No.	Depth to Groundwater Immediately After Boring (feet)
B-01	18.5
B-02	NE
B-03	19
B-04	NE
B-05	NE
B-06	18
B-07	NE
B-08	15.5
B-09	17
B-10	NE
B-11	16
B-12	NE

Boring No.	Depth to Groundwater Immediately After Boring (feet)
B-13	21.5
B-14	22
D-1	NE
D-2	NE
D-3	NE
D-4	NE
D-5	NE
D-6	NE
D-7	NE
D-8	NE
D-9	NE
D-10	NE
D-11	NE
NE = Not Encountered; NR = Not Recorded	

It should be noted that groundwater levels fluctuate due to seasonal and climatic changes in the amount of precipitation, runoff, and other factors. The range of these fluctuations in the Coastal Plain geologic setting is typically on the order of 5 feet.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based on our understanding of the proposed construction and load information, site observations, our evaluation and interpretation of the field data obtained during this exploration, our experience with similar subsurface conditions, and generally accepted geotechnical engineering principles and practices.

Subsurface conditions in unexplored locations or at other times may vary from those encountered at specific testing locations. If such variations are noted during construction, or if project development plans are changed, we request the opportunity to review the changes and amend our recommendations, if necessary.

5.1 SITE GRADING

5.1.1 Site Preparation

Site preparation should begin with clearing and grubbing the site. The complete root systems of the large mature trees should be removed. Topsoil and vegetation should be stripped from construction areas. Based on the borings, we anticipate average top soil stripping depths of 2 to 5 inches. However, topsoil stripping depths are expected to be deeper in some places and should be evaluated by a representative of NOVA at the time of construction.

After clearing and grubbing, the subgrade should be generally evaluated for plasticity. Soils with a liquid limit of more than 60 and a plasticity index of more than 30 will not

be suitable within 2 feet of subgrade elevations for foundations and pavements and floor slabs. We expect isolated pockets of these materials may be encountered during mass grading.

Areas at grade or where fill will be placed should be proof-rolled under observation by a representative of NOVA. A 20 to 30 ton loaded dump truck or similar pneumatic-tired vehicle should make multiple passes to identify soft/loose, compressible, or otherwise unsuitable materials at the time of construction. Materials exhibiting excessive deflection should be remediated through over-excavation and replaced with engineered fill. Due to the moisture sensitivity of the near surface silts and clays, we expect more remedial effort to address unstable soils will be required if construction is performed during seasons and/or periods of wet weather. We also expect less remedial effort will be required to address unstable soils if in place compaction with a vibratory kneading roller is performed to re-densify the soft/loose conditions created by past agricultural use and the proposed clearing and grubbing.

5.1.2 Soil Suitability

Engineered fill materials should be free of organic matter, have a plasticity index of less than 30, and a particle size of no more than 3 inches in any dimension. We expect that a majority of the onsite soils meet this requirement. On site soils that do not meet this requirement may be placed in areas where deeper fills are planned provided they are not located within 2 feet of the subgrade elevation for foundations, pavements, and floor slabs. In their current state, many of the near surface soils encountered will likely require drying prior to compaction as engineered fill.

5.1.3 Fill Placement

Fill should be placed in thin, horizontal loose lifts (maximum 12-inch; preferably 8 inch) and compacted to at least 95 percent of the Standard Proctor maximum dry density (ASTM D698). The upper 8 inches of soil beneath slab-on-grade areas should be compacted to at least 98 percent of the Standard Proctor Value. In confined areas, such as utility trenches, portable compaction equipment and thinner fill lifts (3 to 4 inches) may be necessary. Fill materials used in structural areas should have a target maximum dry density of at least 95 pounds per cubic foot (pcf). If lighter weight fill materials are used, a geotechnical engineer should be consulted to assess the impact on design recommendations.

Soil moisture content should be maintained within 3 percent of the optimum moisture content. We recommend that the grading contractor have equipment on site during earthwork for both drying and wetting fill soils. Moisture control may be difficult during rainy weather. Soils excavated from locations with perched groundwater will likely require significant efforts to achieve acceptable moisture contents prior to re-

use as fill.

Fill placement should be observed by a soils technician, who can confirm suitability of material used and uniformity and appropriateness of compaction efforts. The technician should document compliance with the specifications by performing field density tests using nuclear methods (ASTM D 2922). We recommend test locations be well distributed throughout the fill mass. When filling in small areas, at least one test per day per area should be performed.

5.1.4 Excavations

We expect excavations can be performed with conventional earth moving equipment such as backhoes or excavators.

Groundwater, if encountered in trenches or other excavations, will require dewatering to achieve site grading and compaction of engineered fill to meet the project specifications. Perched groundwater could be encountered in some isolated locations throughout the site.

The potential impacts of difficult excavation conditions and groundwater should be considered while developing the site grading plan.

5.2 SHALLOW FOUNDATIONS

5.2.1 Spread Footing Foundation Design

In our opinion, the planned structures may be supported on shallow, spread footing foundations or monolithic turndown slab foundations. As discussed below, the subgrade for shallow foundations should be further evaluated at the time of construction. As discussed in Section 5.1, a vertical separation of at least 2 feet should be maintained between highly plastic soils and the subgrade for foundations. We expect isolated pockets of these materials may be encountered during mass grading.

Description	Value
Foundation Subgrade	Approved native soil or engineered fill extending to approved native soil
Net allowable bearing pressure ¹	2,500 psf
Minimum embedment below lowest adjacent finished grade for frost protection and protective embedment ²	18 inches
Minimum width for continuous wall footings	16 inches
Minimum width for isolated column footings	24 inches
Approximate total settlement ³	Up to 1 inch
Estimated differential settlement ³	Less than ¾ inch over 40 feet
Coefficient of Lateral Sliding Resistance	0.35

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation.
2. For perimeter footings and footings beneath unheated areas.
3. The actual magnitude of settlement that will occur beneath the foundations will depend upon the site earthwork phase, careful evaluation of foundation bearing conditions at the time of construction and the structural loading conditions. The estimated total and differential settlements listed assume that the foundation related earthwork and the foundation design are completed in accordance with our recommendations.

5.2.2 Spread Footing Construction Considerations

Foundation excavations should be evaluated by the NOVA geotechnical engineer prior to reinforcing steel placement to observe foundation subgrade preparation and confirm bearing pressure capacity. Excessively soft, loose or wet bearing soils should be over-excavated and replaced with compacted engineered fill as described in this report.

Foundation excavations should be level and free of debris, ponded water, mud, and loose, or water-softened soils. Concrete should be placed as soon as is practical after the foundation is excavated and the subgrade evaluated. Foundation concrete should not be placed on saturated soil. If a foundation excavation remains open overnight, or if rain is imminent, a 3 to 4-inch thick "mud mat" of lean concrete should be placed in the bottom of the excavation to protect the bearing soils until reinforcing steel and concrete can be placed.

5.3 FLOOR SLABS

A subgrade prepared and tested as recommended in this report should provide adequate support for lightly loaded floor slabs. As discussed in Section 5.1, a vertical separation of at least 2 feet should be maintained between highly plastic soils and the subgrade for foundations. We expect isolated pockets of these materials may be encountered during mass grading.

The floor slab subgrade should consist of new engineered fill or approved existing soils and should include a minimum 6-inch thick layer of crushed aggregate base course (NCDOT CABC). For point loading conditions, the slab may be designed based on a 100 psi/in value for the modulus of subgrade reaction.

Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or any cracks in pavement areas that develop should be sealed with a waterproof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

The use of a vapor retarder or barrier should be considered beneath concrete slabs on grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings. The use of a vapor retarder should be considered. The slab designer and slab contractor should refer to ACI 302 and ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

5.4 PAVEMENTS

A subgrade prepared as recommended in this report should be suitable for support of pavements. As discussed in Section 5.1, a vertical separation of at least 2 feet should be maintained between highly plastic soils and the subgrade for pavements. We expect isolated pockets of these materials may be encountered during mass grading. Pavement thickness design is dependent upon:

- the anticipated traffic conditions during the life of the pavement;
- subgrade and paving material characteristics; and
- climatic conditions of the region.

Recommended pavement sections are listed in the table below. Two pavement section alternatives have been provided. Light duty pavement sections are recommended for areas that will be subjected to passenger cars and pickup truck traffic. Heavy duty areas are recommended for areas that will experience truck and bus traffic. For our heavy-duty design, we have assumed 500,000 equivalent single axle loads (ESALs) over a 20-year design life. If actual anticipated traffic loadings vary from what we have assumed, we request the opportunity to revise our recommended pavement sections.

Pavement Type	Material	Layer Thickness (inches)	
		Light Duty / Car Parking	Heavy Duty / Truck Traffic Lanes
Rigid	Portland Cement Concrete (4,000 psi)	5 (min)	7 (min)
	Crushed Aggregate Base Course (NCDOT CABC Type 1 or Type 2)	4	6
Flexible (Superpave)	Asphalt Surface (NCDOT S-9.5A)	3 ¹	2
	Asphalt Binder (NCDOT I-19.0B)	--	3
	Crushed Aggregate Base Course (NCDOT CABC Type 1 or Type 2)	6	8
1. Place in two lifts			

The placement of a partial pavement thickness for use during construction is not suggested without a detailed pavement analysis incorporating construction traffic. In addition, we should be contacted to confirm the traffic assumptions outlined above. If the actual traffic varies from the assumptions outlined above, modification of the pavement section thickness will be required.

Recommendations for pavement construction presented depend upon compliance with recommended material specifications. To assess compliance, observation and testing should be performed under the direction of the geotechnical engineer.

Asphalt concrete aggregates and base course materials should conform to the North Carolina Department of Transportation (NCDOT) "Standard Specifications for Roads and Structures." Concrete pavement should be air-entrained and have a minimum compressive strength of 4,000 psi after 28 days of laboratory curing per ASTM C-31.

The performance of all pavements can be enhanced by minimizing excess moisture which can reach the subgrade soils. The following recommendations should be considered a minimum:

- site grading at a minimum 2 percent grade away from the pavements;
- subgrade and pavement surface with a minimum ¼ inch per foot (2%) slope to promote proper surface drainage; and
- installation of joint sealant to seal joints and/or cracks immediately.

Preventative maintenance should be planned and provided for through an ongoing pavement management program to enhance future pavement performance. Preventative maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Preventative maintenance, which consists of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance

(e.g. surface sealing), is usually the first priority when implementing a planned pavement maintenance program and provides the highest return on investment for pavements.

5.5 SEISMIC CONSIDERATIONS

Item	Seismic Parameter
2015 International Building Code (IBC) Seismic Site Classification	D ¹

1. To define the IBC Seismic Site Class for this project, we considered the results of the two geophysical tests conducted on site to evaluate the weighted shear wave velocity profile for the upper 100 feet of the subsurface profile.

Liquefaction, or a sudden loss of soil strength under seismic loading, can be a concern for loose, clean sands below the water table such as those apparently encountered from 20 to 25 feet bgs in Boring No. B-1. However, based on experience in Johnston County, the low SPT N-values in the sandier soils encountered below the water table are likely attributable to error introduced by hollow stem auger boring in these conditions rather than actual loose or very loose conditions. For this reason, we do not expect liquefaction to occur under the magnitude of the seismic events predicted for the area.

5.6 STORMWATER BMP

A grading plan was not available at the time of this evaluation. If construction of a stormwater BMP is planned, we recommend that a determination of the depth to a seasonal high groundwater and infiltration rates be determined by a qualified professional to assist with design of the stormwater BMPs.

5.7 LATERAL EARTH PRESSURES

For soils above any free water surface, recommended equivalent fluid pressures for restrained elements (restricted from moving laterally) below grade such as dock walls are:

At Rest:

Cohesive soil backfill (on-site or imported clays, silts, silty sand) ... 65 psf/ft

Cohesionless soil backfill (on-site or imported sand/gravel)..... 55 psf/ft

Where the design includes unrestrained elements (free to move laterally) such as cast-in-place retaining walls, the following equivalent fluid pressures are recommended:

Active:

Cohesive soil backfill (on-site or imported clays, silts, silty sand) ... 45 psf/ft
Cohesionless soil backfill (on-site or imported sand/gravel)..... 35 psf/ft

Passive:

Cohesive soil backfill (on-site or imported clays, silts, silty sand) . 300 psf/ft
Cohesionless soil backfill (on-site imported sand/gravel) 350 psf/ft

The lateral earth pressures provided are based on backfill compacted to between 95% and 98% of the standard Proctor maximum dry density. The lateral earth pressures herein do not include any factor of safety and are not applicable for submerged soils/hydrostatic loading.

6.0 QUALIFICATIONS OF RECOMMENDATIONS

The findings, conclusions and recommendations presented in this report represent our professional opinions concerning subsurface conditions at the site. The opinions presented are relative to the dates of our site work and should not be relied on to represent conditions at later dates or at locations not explored. The opinions included herein are based on information provided to us, the data obtained at specific locations during the study and our past experience. If additional information becomes available that might impact our geotechnical opinions, it will be necessary for NOVA to review the information, reassess the potential concerns, and re-evaluate our conclusions and recommendations.

Regardless of the thoroughness of a geotechnical exploration, there is the possibility that conditions between test locations will differ from those encountered at specific test locations, that conditions are not as anticipated by the designers and/or the contractors, or that either natural events or the construction process have altered the subsurface conditions. These variations are an inherent risk associated with subsurface conditions in this region and the approximate methods used to obtain the data. These variations may not be apparent until construction.

The professional opinions presented in this geotechnical report are not final. Field observations and foundation installation monitoring by the geotechnical engineer, as well as soil density testing and other quality assurance functions associated with site earthwork and foundation construction, are an extension of this report. Therefore, NOVA should be retained to observe all earthwork and foundation construction to document that the conditions anticipated in this study actually exist, and to finalize or amend our conclusions and recommendations. NOVA is not responsible or liable for the conclusions and recommendations presented in this report if NOVA does not perform these observation and testing services.

This report is intended for the sole use of Hite Associates, P.C. for the above noted project. The scope of work performed during this study may not satisfy other users requirements. Use of this report or

the findings, conclusions or recommendations by others will be at the sole risk of the user. NOVA is not responsible or liable for the interpretation by others of the data in this report, nor their conclusions, recommendations or opinions.

Our professional services have been performed, our findings obtained, our conclusions derived and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices in the State of North Carolina. This warranty is in lieu of all other statements or warranties, either expressed or implied.

We recommend that subsequent to a site grading plan being completed, and traffic loadings are provided, NOVA be provided an opportunity to review our recommendations, and assist in evaluation of on site soil use during the development of this project site.

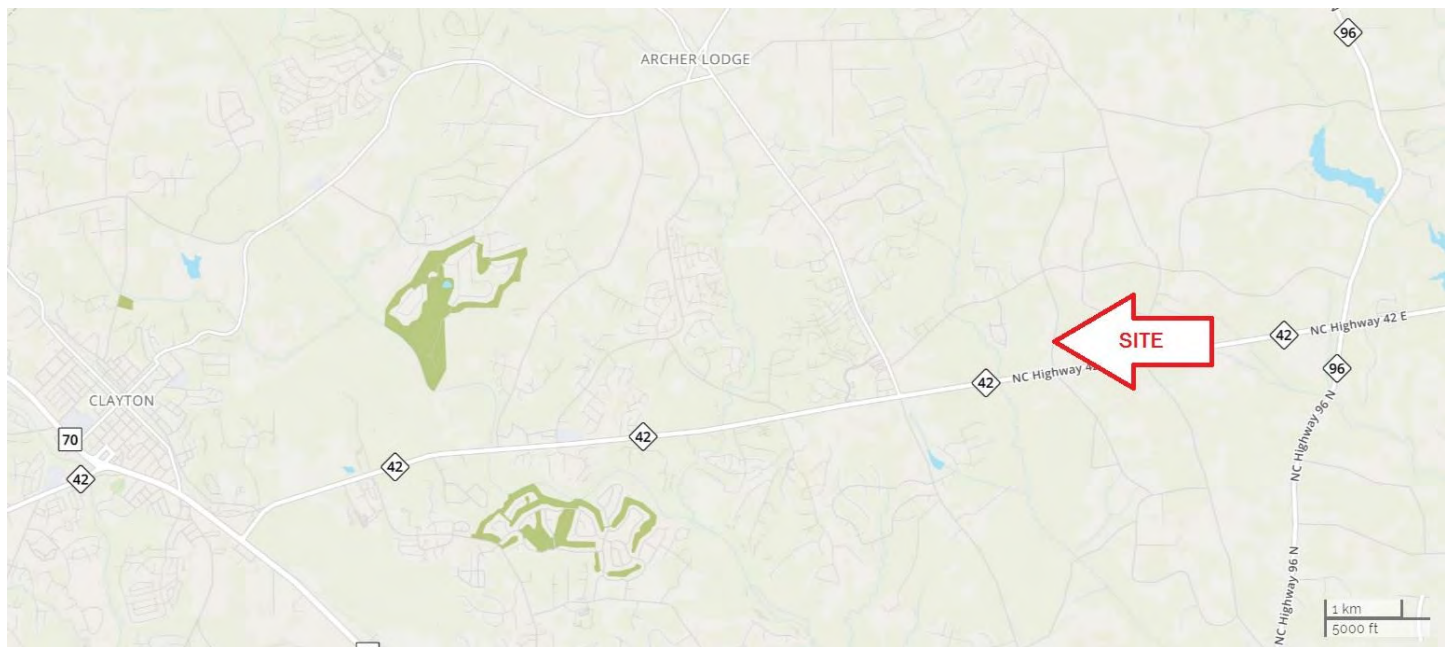


FIGURE 1
SITE LOCATION MAP

SOURCE: www.google.com/maps
www.mapquest.com

DATE: 2019
SCALE: As Shown



Hite Associates, P.C.
JCS – Archer Area Elementary
Selma, Johnston County, NC
NOVA Project Number 10727-2019022

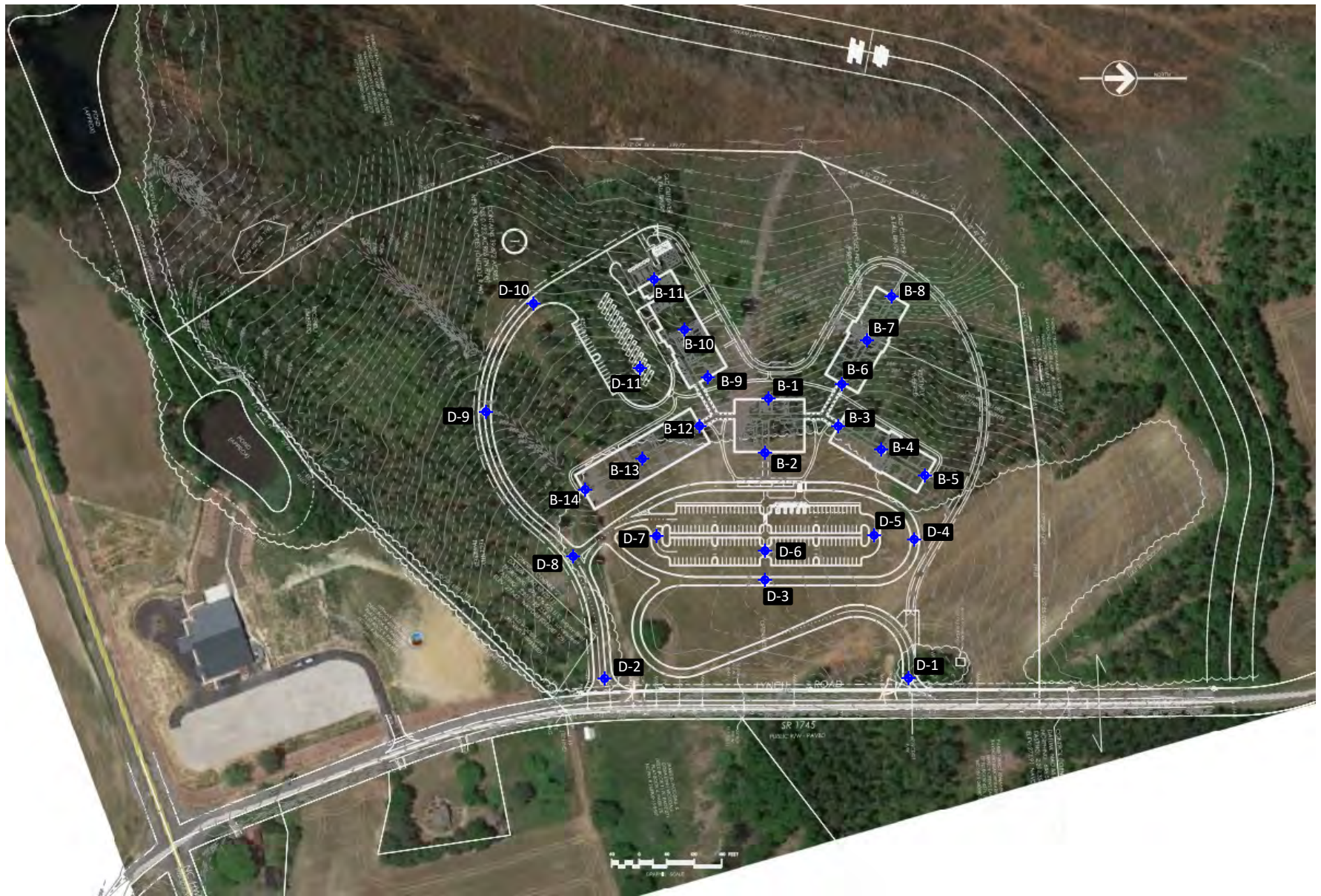


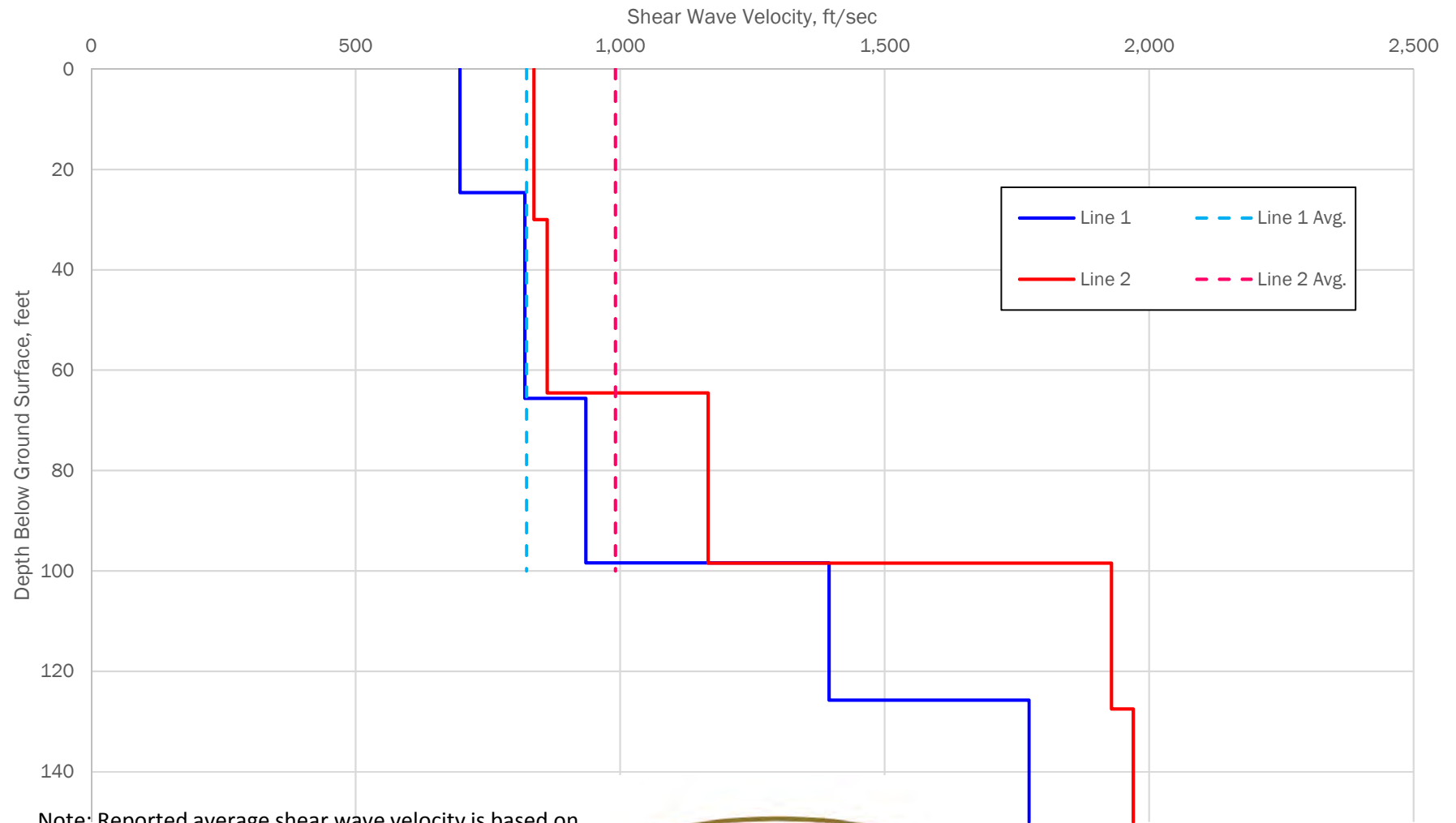
FIGURE 2
Boring Location Plan

SCALE: As Shown



Hite Associates, P.C.
JCS – Archer Area Elementary
Selma, Johnston County, NC
NOVA Project Number 10727-2019022

Shear Wave Velocity Profile Line 1 & Line 2



Note: Reported average shear wave velocity is based on the profile through a depth of 100 feet per the IBC.



FIGURE 3



TEST BORING RECORD B-01

PROJECT NAME: Archer Area Elementary School Site DATE: 8/6/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +267 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): ▼ 18.5 SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL
0		TOPSOIL , 4 inches					
	265	lean CLAY (CL-CH) , red orange, medium stiff to very stiff, moist				7	●
						23	●
5		silty SAND (SM) , tan orange, medium dense to dense, moist				29	▲
	260					25	●
		silty CLAY (CL) with sand , gray red orange, very stiff, moist					
10							
	255						
		silty clayey SAND (SC-SM) , tan, loose, moist to wet				8	●
15							
	250						
				▼		4	●
20							
	245	poorly graded SAND (SP-SM) with silt , tan, very loose, wet				4	●
25							
		Boring Terminated at 25 feet					
	240						
30							
	235						
35							

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers

N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD B-02

PROJECT NAME: Archer Area Elementary School Site DATE: 8/5/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +273 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): ▼ N/E SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL 10 20 30 40 50 60 70 80 90									
0		TOPSOIL , 4 inches														
		lean CLAY (CL-CH) , red orange, medium stiff to stiff, moist				9	●									
5	270	silty SAND (SM) , tan orange, medium dense, moist				23	●									
						23	●									
	265					21	●									
10		silty CLAY (CL) , red orange tan, soft, moist				6	●									
	260															
15		silty clayey SAND (SC-SM) , tan gray orange, very loose, moist to wet				4	●									
	255															
20						6	●									
	250															
25		Boring Terminated at 25 feet														
	245															
30																
	240															
35																

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers

N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD B-03

PROJECT NAME: Archer Area Elementary School Site DATE: 8/6/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +266 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): ▼ 19 SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL
0							10 20 30 40 50 60 70 80 90
	265	TOPSOIL , 2 inches					
		lean CLAY (CL-CH) , red orange, medium stiff to stiff, moist				9	●
		silty SAND (SM) , tan orange, medium dense, moist				22	●
5							
	260	silty CLAY (CL) with sand , gray red orange, very stiff to hard, moist				39	●
						17	●
10							
	255	silty clayey SAND (SC-SM) , tan orange red, loose, moist				9	●
15							
	250	silty clayey SAND (SC-SM) , tan orange, loose, moist to wet				5	●
20							
	245	poorly graded SAND (SP-SM) with silt , tan, loose, wet				5	●
25							
	240	Boring Terminated at 25 feet					
30							
	235						
35							

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers

N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD B-04

PROJECT NAME: Archer Area Elementary School Site DATE: 8/5/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +269 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): N/E SECONDARY GW LEVEL (ft): FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL
0		TOPSOIL , 3 inches					
		silty to sandy fat CLAY (CH) , red-brown to red-orange and gray, stiff to very stiff, moist					
	265					15	●
5						20	●
						25	●
	260	silty SAND (SM) , red tan, medium dense, moist				13	●
10							
		silty clayey SAND (SC-SM) , tan orange red gray, medium dense, moist				11	●
15	255						
		silty clayey SAND (SC-SM) , orange tan red, loose, moist to wet				9	●
20	250						
						6	●
25	245						
		Boring Terminated at 25 feet					
	240						
30							
	235						
35							

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers

N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD B-05

PROJECT NAME: Archer Area Elementary School Site DATE: 8/5/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +267 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): ▼ N/E SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL 10 20 30 40 50 60 70 80 90									
0		TOPSOIL , 3 inches														
	265	silty CLAY (CL) , orange tan, stiff, moist				13	●	▲								
5		silty SAND (SM) , red tan orange, medium dense, moist				16	●	▲								
	260					22		●								
		silty CLAY (CL) , gray orange red, stiff, moist				12	●	▲								
10																
	255	silty CLAY (CL) , red orange tan, stiff, moist				14	●		▲							
15																
	250	silty clayey SAND (SC-SM) , red orange tan, loose to very loose, moist				8	●	▲								
20																
	245					6	●		▲							
25																
		Boring Terminated at 25 feet														
	240															
30																
	235															
35																

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers

N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD B-06

PROJECT NAME: Archer Area Elementary School Site DATE: 8/6/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +262 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): ▼ 18 SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL
0		TOPSOIL , 4 inches					
	260	lean CLAY (CL-CH) , red orange, stiff to very stiff, moist				11	
						18	
5		silty SAND (SM) , tan orange, dense, moist				31	
	255					26	
		silty CLAY (CL) with sand , gray orange red, very stiff to stiff, moist					
10						10	
	250						
15		silty clayey SAND (SC-SM) , tan orange, loose, moist to wet		▼		5	
	245						
20		poorly graded SAND (SP-SM) with silt , tan, loose, wet				4	
	240						
25		Boring Terminated at 25 feet					
	235						
30							
	230						
35							

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers

N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD B-07

PROJECT NAME: Archer Area Elementary School Site DATE: 8/13/2019
PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
PROJECT LOCATION: Selma, NC
LOCATION: See Boring Location Plan ELEVATION: +255 feet NAVD88
DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
INITIAL GW LEVEL (ft): ▼ N/E SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	<div>● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%)</div> <div>PL LL 10 20 30 40 50 60 70 80 90</div>									
0	255	TOPSOIL , 4 inches			8	8	●									
		silty SAND (SM) , tan brown orange, loose, moist														
5	250	sandy SILT (ML) , tan gray red orange, stiff to medium stiff, moist			9	5	●									
10	245	sandy SILT (ML) , tan brown orange, medium stiff, moist to wet														
15	240				7	5	●									
20	235	Boring Terminated at 20 feet														
25	230															
30	225															
35	220															

Note: N-Values are uncorrected
HSAs = Hollow-Stem Augers

N/E = Not Encountered
FIAD = Filled In After Drilling



TEST BORING RECORD B-08

PROJECT NAME: Archer Area Elementary School Site DATE: 8/13/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +249 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): ▼ 15.5 SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL 10 20 30 40 50 60 70 80 90									
0		TOPSOIL , 2 inches														
		silty SAND (SM) , tan brown orange, loose, moist				6	●									
	245					9	●									
5		sandy SILT (ML) , tan gray red orange, stiff to medium stiff, moist				6	●									
	240					4	●									
10		sandy SILT (ML) , tan brown orange, medium stiff, moist to wet				5	●									
	235					4	●									
15				▼												
	230															
20		Boring Terminated at 20 feet														
	225															
25																
	220															
30																
	215															
35																

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers

N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD B-09

PROJECT NAME: Archer Area Elementary School Site DATE: 8/6/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +263 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): 17 SECONDARY GW LEVEL (ft): FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL 10 20 30 40 50 60 70 80 90									
0		TOPSOIL , 3 inches														
	260	lean CLAY (CL-CH) , orange tan, medium stiff, moist				6	●									
5		sandy SILT (ML) , tan brown to gray, orange, and red, very stiff to stiff, moist				16	●									
	255					13	●									
10						9	●									
	250	silty clayey SAND (SC-SM) , orange red gray, loose, moist				9	●									
15		silty clayey SAND (SC-SM) , tan orange, loose to very loose, moist to wet				3	●									
20		Boring Terminated at 20 feet														
	240															
25																
	235															
30																
	230															
35																

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers

N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD B-10

PROJECT NAME: Archer Area Elementary School Site DATE: 8/13/2019
PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
PROJECT LOCATION: Selma, NC
LOCATION: See Boring Location Plan ELEVATION: +255 feet NAVD88
DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
INITIAL GW LEVEL (ft): ▼ N/E SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	<div>● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%)</div> <div>PL LL 10 20 30 40 50 60 70 80 90</div>									
0	255	TOPSOIL , 5 inches														
		silty SAND (SM) , tan brown orange, loose, moist				4	●									
						9	●									
5	250	sandy SILT (ML) , tan gray red orange, stiff to medium stiff, moist				8	●									
						5	●									
10	245	sandy SILT (ML) , tan brown orange, medium stiff, moist to wet				6	●									
15	240					6	●									
20	235	Boring Terminated at 20 feet														
25	230															
30	225															
35	220															

Note: N-Values are uncorrected
HSAs = Hollow-Stem Augers

N/E = Not Encountered
FIAD = Filled In After Drilling



TEST BORING RECORD B-11

PROJECT NAME: Archer Area Elementary School Site DATE: 8/13/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +246 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): ▼ 16 SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL 10 20 30 40 50 60 70 80 90
0							
	245	TOPSOIL , 5 inches					
		silty CLAY (CL) , tan orange, stiff, moist				9	●
		silty SAND (SM) , red orange tan, medium dense, moist				21	●
5							
	240	sandy SILT (ML) , gray orange red, stiff to medium stiff, moist				9	●
						7	●
10							
	235						
		sandy SILT (ML) , orange gray tan, medium stiff to soft, moist to wet				5	●
15							
	230			▼			
						4	●
20							
	225	Boring Terminated at 20 feet					
25							
	220						
30							
	215						
35							

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers

N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD B-12

PROJECT NAME: Archer Area Elementary School Site DATE: 8/6/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +270 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): N/E SECONDARY GW LEVEL (ft): FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL 10 20 30 40 50 60 70 80 90									
0	270	TOPSOIL , 2 inches														
		silty CLAY (CL) , orange tan gray red, stiff to very stiff, moist				9										
5	265	silty SAND (SM) , tan orange, medium dense, moist				20										
		silty SAND (SM) , tan orange, medium dense, moist				21										
10	260	silty clayey SAND (SC-SM) , orange tan gray, medium dense to loose, moist				10										
		silty clayey SAND (SC-SM) , orange tan gray, medium dense to loose, moist				10										
15	255	silty clayey SAND (SC-SM) , red orange gray, loose, moist				5										
20	250	silty clayey SAND (SC-SM) , red orange gray, loose, moist				4										
25	245	Boring Terminated at 25 feet														
30	240															
35	235															

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers

N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD B-13

PROJECT NAME: Archer Area Elementary School Site DATE: 8/5/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +272 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): ▼ 21.5 SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL 10 20 30 40 50 60 70 80 90									
0		TOPSOIL , 4 inches														
	270	sandy CLAY (CL) , orange tan, stiff, moist				12	●									
						16	●									
5		silty CLAY (CL) , orange tan red gray, very stiff to stiff, moist				26	●									
	265					15	●									
10																
	260	silty clayey SAND (SC-SM) , red orange gray, loose, moist				7	●									
15																
	255	silty clayey SAND (SC-SM) , tan gray orange, loose, moist to wet				6	●									
20																
	250			▼		5	●									
25																
		Boring Terminated at 25 feet														
	245															
30																
	240															
35																

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers

N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD B-14

PROJECT NAME: Archer Area Elementary School Site DATE: 8/5/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +272 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): ▼ 22 SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL
0		TOPSOIL , 2 inches					
	270	lean CLAY (CL-CH) , tan orange, soft, moist				4	●
		silty SAND (SM) , tan orange, medium dense, moist				20	●
5		silty CLAY (CL) with sand , red orange gray, very stiff to stiff, moist				25	●
	265					13	●
10		silty CLAY (CL) , red orange gray, medium stiff, moist				5	●
	260						
15		silty clayey SAND (SC-SM) , orange tan gray, loose, moist to wet				4	●
	255						
20						6	●
	250						
25		Boring Terminated at 25 feet					
	245						
30							
	240						
35							

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers

N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD D-01

PROJECT NAME: Archer Area Elementary School Site DATE: 8/16/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +271 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): ▼ N/E SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL
0							10 20 30 40 50 60 70 80 90
	270	TOPSOIL , 2 inches				17	●
		sandy CLAY (CL) , red brown, very stiff, moist				38	●
5		silty SAND (SM) , red gray orange, dense, moist				39	●
	265					14	●
		sandy SILT (ML) , tan orange red, stiff, moist					
10		Boring Terminated at 10 feet					
	260						
15							
	255						
20							
	250						
25							
	245						
30							
	240						
35							

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers

N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD D-02

PROJECT NAME: Archer Area Elementary School Site DATE: 8/13/2019
PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
PROJECT LOCATION: Selma, NC
LOCATION: See Boring Location Plan ELEVATION: +275 feet NAVD88
DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
INITIAL GW LEVEL (ft): ▼ N/E SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	<div>● N-Value (Blows per Foot)</div> <div>▲ Moisture Content (%)</div> <div>◇ Organic Content (%)</div> <div>■ Fines Content (%)</div> <div>PL LL</div> <div>10 20 30 40 50 60 70 80 90</div>									
0	275	TOPSOIL , 4 inches														
		silty SAND (SM) , tan brown, loose, moist				8	●									
		sandy SILT (ML) , red brown, very stiff to stiff, moist				16	●									
5	270					12	●									
		sandy SILT (MLS) , tan gray red, stiff, moist				12	●									
10	265	Boring Terminated at 10 feet														
15	260															
20	255															
25	250															
30	245															
35	240															

Note: N-Values are uncorrected
HSAs = Hollow-Stem Augers

N/E = Not Encountered
FIAD = Filled In After Drilling



TEST BORING RECORD D-03

PROJECT NAME: Archer Area Elementary School Site DATE: 8/5/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +282 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): ▼ N/E SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL
0		TOPSOIL , 10 inches					
	280	silty CLAY (CL) , orange brown, medium stiff to stiff, moist				5	●
5						19	●
	275	sandy SILT (ML) , red gray orange, very stiff, moist				31	●
						23	●
10							
	270	SILT (ML) , orange tan gray red, stiff to medium stiff, moist				13	●
15							
	265					6	●
20		Boring Terminated at 20 feet					
	260						
25							
	255						
30							
	250						
35							

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers

N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD D-04

PROJECT NAME: Archer Area Elementary School Site DATE: 8/13/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +267 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): N/E SECONDARY GW LEVEL (ft): FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL 10 20 30 40 50 60 70 80 90									
0		TOPSOIL, 10 inches														
	265	sandy CLAY (CL), red brown, medium stiff to stiff, moist				7	●									
						16	●									
5		silty SAND (SM), red brown orange, dense to medium dense, moist				31	●									
	260					14	●									
10		Boring Terminated at 10 feet														
	255															
15																
	250															
20																
	245															
25																
	240															
30																
	235															
35																

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers




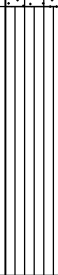
N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD D-05

PROJECT NAME: Archer Area Elementary School Site DATE: 8/13/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +274 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): ▼ N/E SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL
0		TOPSOIL , 4 inches					
		sandy CLAY (CL) , red brown, stiff, moist			9	●	
5	270	silty SAND (SM) , orange brown red, medium dense, moist			21	●	
					22	●	
10	265	sandy SILT (ML) , tan orange red, stiff, moist			12	●	
15	260				12	●	
		Boring Terminated at 15 feet					
	255						
20							
	250						
25							
	245						
30							
	240						
35							

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers





N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD D-06

PROJECT NAME: Archer Area Elementary School Site DATE: 8/13/2019
PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
PROJECT LOCATION: Selma, NC
LOCATION: See Boring Location Plan ELEVATION: +281 feet NAVD88
DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
INITIAL GW LEVEL (ft): ▼ N/E SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL 10 20 30 40 50 60 70 80 90												
0																			
	280	TOPSOIL, 10 inches																	
		sandy CLAY (CL), red brown, stiff to very stiff, moist			10	●													
					23	●													
5																			
	275	silty SAND (SM), tan orange, medium dense, moist			24	●													
		sandy SILT (ML), tan orange red, very stiff, moist			16	●													
10																			
	270	Boring Terminated at 10 feet																	
15																			
	265																		
20																			
	260																		
25																			
	255																		
30																			
	250																		
35																			

Note: N-Values are uncorrected
HSAs = Hollow-Stem Augers

N/E = Not Encountered
FIAD = Filled In After Drilling



TEST BORING RECORD D-07

PROJECT NAME: Archer Area Elementary School Site DATE: 8/5/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +278 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): ▼ N/E SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL
0		TOPSOIL , 10 inches					
		sandy CLAY (CL) , tan brown, soft, moist			3	●	
275		sandy CLAY (CL) , orange brown, very stiff, moist			18	●	
5					20	●	
270		SILT (ML) , red orange brown, stiff to soft, moist			16	●	
10							
265					5	●	
15							
260					4	●	
20							
		Boring Terminated at 20 feet					
255							
25							
250							
30							
245							
35							

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers





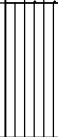
N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD D-08

PROJECT NAME: Archer Area Elementary School Site DATE: 8/13/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +274 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): ▼ N/E SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL 10 20 30 40 50 60 70 80 90									
0		TOPSOIL , 4 inches														
		silty CLAY (CL) , brown orange, medium stiff, moist			8	●										
5	270	sandy SILT (ML) , tan orange red, stiff, moist			14	●										
		silty SAND (SM) , tan orange red, medium dense, moist			17	●										
10	265				11	●										
		sandy SILT (ML) , tan orange gray, medium stiff, moist to wet			7	●										
15	260	Boring Terminated at 15 feet														
	255															
20																
	250															
25																
	245															
30																
	240															
35																

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers





N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD D-09

PROJECT NAME: Archer Area Elementary School Site DATE: 8/6/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +266 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): ▼ N/E SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL 10 20 30 40 50 60 70 80 90									
0																
	265	TOPSOIL , 2 inches														
		sandy CLAY (CL) , orange brown, medium stiff, moist				7	●									
		silty SAND (SM) , orange gray, medium dense, moist				16	●									
5																
	260					12	●									
		SILT (ML) , orange gray, stiff, moist				9	●									
10																
	255	Boring Terminated at 10 feet														
15																
	250															
20																
	245															
25																
	240															
30																
	235															
35																

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers





N/E = Not Encountered
 FIAD = Filled In After Drilling



TEST BORING RECORD D-10

PROJECT NAME: Archer Area Elementary School Site DATE: 8/13/2019
PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
PROJECT LOCATION: Selma, NC
LOCATION: See Boring Location Plan ELEVATION: +249 feet NAVD88
DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
INITIAL GW LEVEL (ft): ▼ N/E SECONDARY GW LEVEL (ft): ▽ FIAD

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL
0		TOPSOIL , 2 inches					
		silty CLAY (CL) , brown orange, medium stiff, moist				8	●
	245	silty SAND (SM) , tan brown red, medium dense, moist				28	●
5						16	●
	240	sandy SILT (ML) , tan gray red, very stiff, moist				20	●
10		Boring Terminated at 10 feet					
	235						
15							
	230						
20							
	225						
25							
	220						
30							
	215						
35							

Note: N-Values are uncorrected
HSAs = Hollow-Stem Augers

N/E = Not Encountered
FIAD = Filled In After Drilling



TEST BORING RECORD D-11

PROJECT NAME: Archer Area Elementary School Site DATE: 8/6/2019
 PROJECT NO.: 10727-2019022 CLIENT: Hite Associates, P.C.
 PROJECT LOCATION: Selma, NC
 LOCATION: See Boring Location Plan ELEVATION: +258 feet NAVD88
 DRILLED BY: Carolina Drilling Inc. LOGGED BY: GS
 DRILLING METHOD: 2-1/4" HSAs HAMMER: Automatic
 INITIAL GW LEVEL (ft): ▼ N/E SECONDARY GW LEVEL (ft): ▽ FIAD

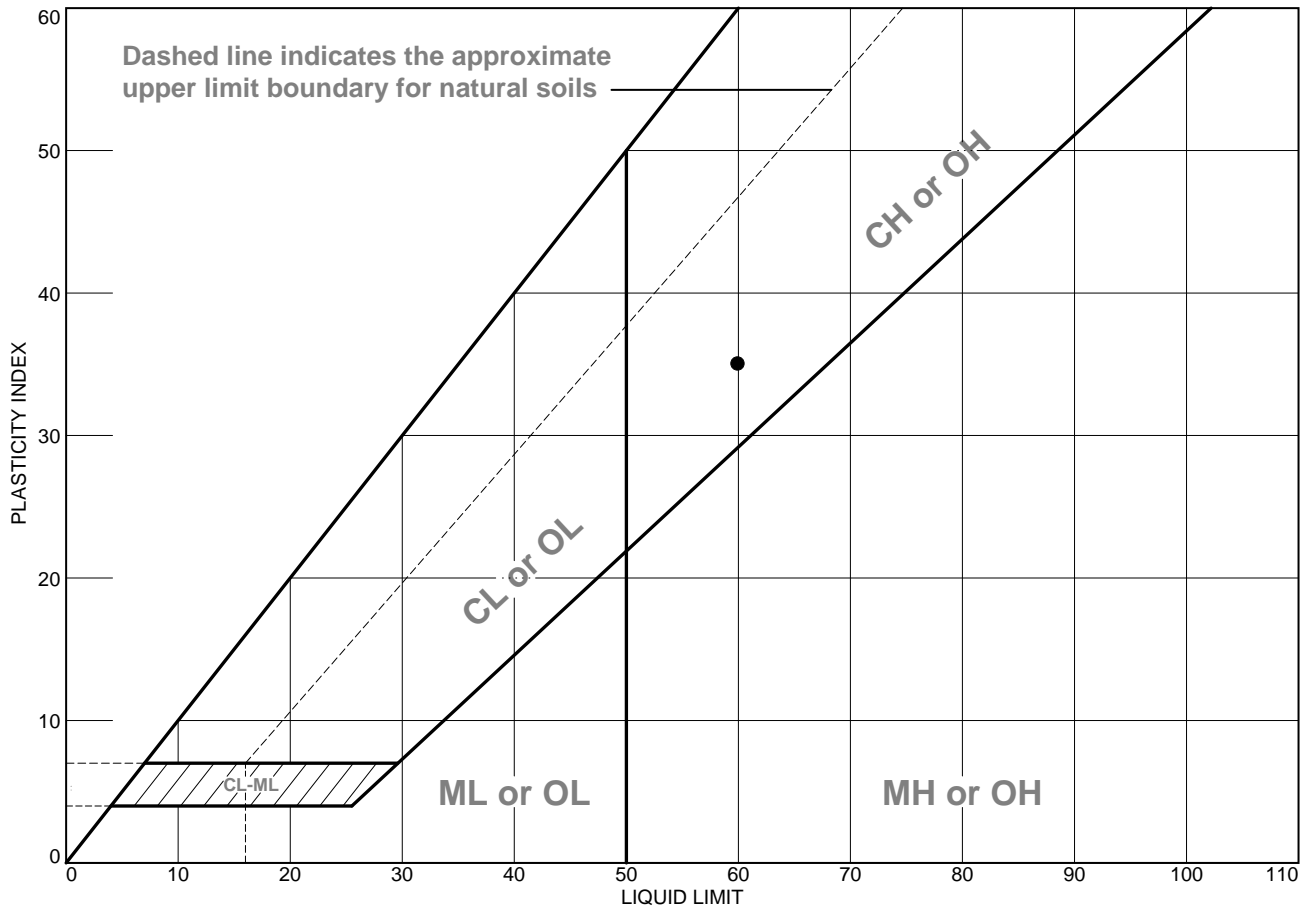
This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Elevation	Material Description	Graphic	Groundwater	Sample Type	N-Value	● N-Value (Blows per Foot) ▲ Moisture Content (%) ◇ Organic Content (%) ■ Fines Content (%) PL LL 10 20 30 40 50 60 70 80 90
0		TOPSOIL , 2 inches					
		silty CLAY (CL) , orange brown, stiff, moist			9	●	
	255						
		silty SAND (SM) , brown gray, medium dense, moist			22	●	
5							
		sandy SILT (ML) with gravel , tan orange gray, stiff, moist			12	●	
	250						
					11	●	
10		Boring Terminated at 10 feet					
	245						
15							
	240						
20							
	235						
25							
	230						
30							
	225						
35							

Note: N-Values are uncorrected
 HSAs = Hollow-Stem Augers

N/E = Not Encountered
 FIAD = Filled In After Drilling

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	red brown sandy fat CLAY	60	25	35			CH

Project No. 10727-2019022 **Client:** Hite Associates, P.C.

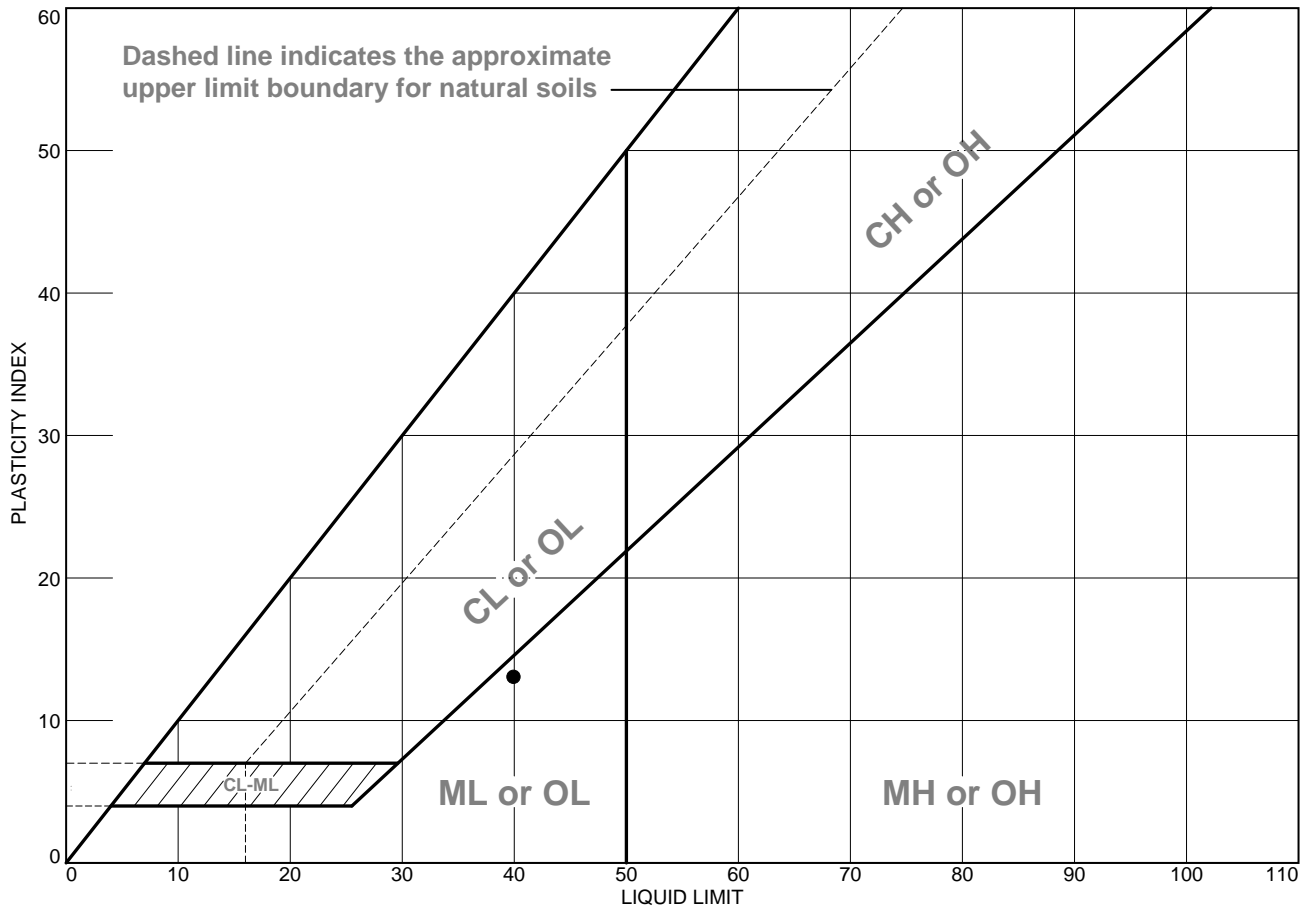
Project: JCS - Archer Area Elementary

● **Source of Sample:** Boring No. B-4, SS-3, 6-7.5 feet

Nova Engineering & Environmental
Raleigh, NC

Tested By: GLASTON JONES **Checked By:** THOMAS BARTLETT

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	tan brown sandy SILT	40	27	13			ML

Project No. 10727-2019022 **Client:** Hite Associates, P.C.

Project: JCS - Archer Area Elementary

● **Source of Sample:** Boring No. B-9, SS-2, 3.5-5 feet

Nova Engineering & Environmental
Raleigh, NC

Tested By: SAM NORTON **Checked By:** THOMAS BARTLETT

Important Information about Your Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one—not even you—should apply the report for any purpose or project except the one originally contemplated.*

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,

- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time to perform additional study.* Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that

have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechnical Engineer for Additional Assistance

Membership in ASFE/THE BEST PEOPLE ON EARTH exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.



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Telephone: 301/565-2733 Facsimile: 301/589-2017

e-mail: info@asfe.org www.asfe.org

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PART 1: GENERAL

Testing laboratory services will be paid for under the cash allowance as indicated in Section 01056 Allowances, to be provided in the General Contractor's bid, as amended below.

DESCRIPTION:

Work Included: From time to time during progress of the work, the Architect may require that testing be performed to determine that materials provided for the work meet the specified requirements; such testing includes, but not necessarily limited to:

- Soils Proofrolling, Cutting & Filling Operations
- Soil Compaction
- Cast-In-Place Concrete & Reinforcing
- Structural Steel & Decking Connections
- Masonry Reinforcing
- Exterior Wall Light Gauge Framing
- Fireproofing
- Spray Foam Insulation Thickness
- Spray Acoustical Insulation Thickness

Related work described elsewhere: Requirements for testing may be described in various sections of these specifications and Drawings; where no testing requirements are described but the Architect decides that testing is required, the Architect may require testing to be performed under current pertinent standards for testing.

Work not included: Selection of testing laboratory: The Architect will select a pre-qualified independent testing laboratory and / or consultant.

QUALITY ASSURANCE:

Qualifications of testing laboratory: The testing laboratory will be qualified to the Architect's approval in accordance with ASTM E-329-70 "Recommended Practice for Inspection and Testing Agencies for Concrete and Steel Used in Construction".

Codes and Standards: Testing, when required, will be in accordance with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

PRODUCT HANDLING:

Promptly process and distribute all required copies of test reports and related instructions to ensure all necessary retesting and/or replacement of materials with the least possible delay in progress of the work.

PART 2: PRODUCTS

PAYMENT FOR TESTING SERVICES:

Initial Services: All testing services shall be paid for by the General Contractor through an allowance per Section 01056 Allowances.

Retesting: When initial tests indicate non-compliance with the contract documents, all subsequent retesting occasioned by the non-compliance shall be performed by the same testing laboratory and the costs thereof will be paid for by the Contractor and not charged to the Owner for Testing.

PART 3: EXECUTION

COOPERATION WITH TESTING LABORATORY:

Representatives of the testing laboratory shall have access to the work at all times; provide facilities for such access in order that the laboratory may properly perform its function.

SCHEDULES FOR TESTING:

Establishing Schedule: By advance discussion with the testing laboratory selected by the Architect, determine the time required for the laboratory to perform its tests and to issue each of its finding.

Provide all required testing time within the construction schedule.

Revising Schedule: When changes of construction schedule are necessary during construction coordinate all such changes of schedule with the testing laboratory as required.

Adherence to Schedule: When the testing laboratory is ready to test according to the determined schedule but is prevented from testing or taking specimens due to incompleteness of work, all extra costs for testing attributable to the delay may be back-charged to the Contractor and shall not be charged to the Owner.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

GENERAL

DESCRIPTION OF WORK:

Work of this Section shall be to provide a Project Sign for each site to be purchased by the Contractor with the project cash allowance specified in 01056, constructed and painted as indicated, and erected on the site in a location selected by the Architect. The project sign shall be maintained by the Contractor until completion of the Project, and repaired and/or relocated as required during the construction period. No other signs will be allowed on the site - the General Contractor will be responsible for enforcing this provision.

END OF SECTION

ABBREVIATIONS AND NAMES: The following acronyms or abbreviations as referenced in contract documents are defined to mean the associated names. Both names and addresses are subject to change, and are believed to be, but are not assured to be, accurate and up-to-date as of date of contract documents:

AA	Aluminum Association 818 Connecticut Ave. NW; Washington DC 20006; 202/862-5100
AAMA	Architectural Aluminum Manufacturers Association 35 E. Southern Bldg.; Washington DC 20005; 202/737-4060
AAN	American Association of Nurserymen 230 Southern Bldg.; Washington, DC 20005; 202/737-4060
AASHTO	American Association of State Highway and Transportation Officials 444 North Capital St.; Washington DC 20001; 202/624-5800
AATCC	American Association of Textile Chemists and Colorists P. O. Box 12215; Research Triangle Park, NC 27709; 919/549-8141
ACI	American Concrete Institute P. O. Box 19150; Detroit, MI 48219; 313/532-2600
ACIL	American Council of Independent Laboratories 1725 K St., NW; Washington DC 20006 202/659-3766
ADC	Air Diffusion Council 230 N. Michigan Aven.; Chicago, IL 60601; 312/372-9800
AGA	American Gas Association 1515 Wilson Blvd., Arlington, VA 22209; 703/841-8400
AHAM	Association of Home Appliance Manufacturers 20 N. Wacker Dr.; Chicago, IL 60606 312/984-5800
AI	Asphalt Institute Asphalt Inst. Bldg.; College Park, MD 20740 301/277-4258
AIA	American Institute of Architects 1735 New York Ave., NW; Washington, DC 20006; 202/626-7474
A.I.A.	American Insurance Association 85 John St.; New York, NY 10038;

	212/699-0400
AISC	American Institute of Steel Construction 400 N. Michigan Ave.; Chicago, IL 60611; 312/670-2400
AISI	American Iron and Steel Institute 1000 16th St., NW; Washington, DC 20036; 202/452-7100
AITC	American Institute of Timber Construction 333 W. Hampden Ave.; Englewood, CO 80110; 303/761-3212
AMCA	Air Movement and Control Association 30 W. University Dr.; Arlington Heights, IL 60004; 312/394-0150
ANSI	American National Standards Institute 1430 Broadway; New York, NY 10018; 212/354-3300
APA	American Plywood Association P. O. Box 11700; Tacoma, WA 98411; 206/565-6600
ARI	Air Conditioning and Refrigeration Institute 1815 N. Fort Myer Dr.; Arlington, VA 22209; 703/524-8800
ASC	Adhesive and Sealant Council 1600 Wilson Blvd.; Arlington, VA 22209; 703/841-1112
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers 1791 Tullie Circle, NE; Atlanta, Ga 30329 404/636-8400
ASME	American Society of Mechanical Engineers 345 East 47th St.; New York, NY 10017; 212/705-7722
ASPE	American Society of Plumbing Engineers 15233 Ventura Blvd.; Sherman Oaks, Ca. 91403 213/783-4845
ASSE	American Society of Sanitary Engineering P. O. Box 9712; Bay Village, OH 44140 216/835-3040
ASTM	American Society for Testing and Materials 1916 Race St.; Philadelphia, CA 19103 215/299-5400

AWI	Architectural Woodwork Institute 2310 S. Walter Reed Dr.; Arlington, VA 22206 703/671-9100
AWPA	American Wood-Preserver's Association 7735 Old Georgetown Rd.; Bethesda, MD 20814 301/652-3109
AWPB	American Wood Preservers Bureau P. O. Box 6085; Arlington, VA 22206 703/931-8180
AWS	American Welding Society P. O. Box 351040; Miami, FL 33135 305/642-7090
AWWA	American Water Works Association 6666 W. Quincy Ave., Denver, CO 80235 303/794-7711
BHMA	Builders' Hardware Manufacturers Association (c/o TGAM) 60 East 42nd St.; New York, NY 10017 212/682-8142
BIA	Brick Institute of America 1750 Old Meadow Rd.; McLean, VA. 22102 703/893-4010
CDA	Copper Development Association 405 Lexington Ave.; New York, NY 10174 212/953-7300
CE	Corps of Engineers (U.S. Dept. of the Army) Washington, DC 20314
CFR	Code of Federal Regulations Available from Government Printing Office; Washington, DC 20402 (usually first published in Federal Register)
CISPI	Cast Iron Soil Pipe Institute 1499 Chain Bridge Rd., McLean, VA. 22101 703/827-9177
CRIGLP	CRI Green Label Plus 730 College Drive Dalton, GA 30720 706-278-3176
CRSI	Concrete Reinforcing Steel Institute 933 Plum Grove Rd., Schamburg, IL 60195 312/372-5059
CS	Commercial Standard of NBS (U.S. Dept. of Commerce)

	Government Printing Office; Washington, DC 20402
DHI	Door and Hardware Institute 7711 Old Springhouse Rd., McLean, VA. 22102 703/556-3990
EIA	Electronic Industries Association 2001 Eye St., NW; Washington, DC 20006 202/457-4900
FAA	Federal Aviation Administration (U. S. Dept. of Transportation) 800 Independence Ave., SW; Washington, DC 20590
FCC	Federal Communications Commission 1919 M St., NW; Washington, D C 20554 202/632-7000
FCI	Fluid Controls Institute U.S. Highway One, Plaza 222; Tequesta, FL 33458; 305/746-6466
FGMA	Flat Glass Marketing Association 3310 Harrison; Topeka, KS 66611; 913/266-7013
FHA	Federal Housing Administration (U. S. Dept. of HUD) 451 - 7th St., SW; Washington, D C 20201
FM	Factory Mutual Engineering Corp. 1151 Boston-Providence Turnpike; Norwood, MA 02062 617/762-4300
FS	Federal Specification (General Services Admin.) Obtain from your Regional GSA Office, or purchase from GSA Specifications Unit (WFSIS); 7th and D Streets, SW; Washington, DC 20406; 202/472-2205 or 2140
FTI	Facing Tile Institute c/o Box 8880; Canton, OH 44711; 216/488-1211
GA	Gypsum Association 1603 Orrington Aven.; Evanston, IL 60201 312/491-1744
HPMA	Hardwood Plywood Manufacturers Association P. O. Box 2789, Reston, VA. 22090 703/435-2900
IEEE	Institute of Electrical and Electronic Engineers, Inc. 345 E. 47th St.; New York, NY 10017; 212/705-790
IESNA	Illuminating Engineering Society of North America

	345 E. 47th St.; New York, NY 10017 212/705-7926
ILI	Indiana Limestone Institute of America Stone City Bank Bldg.; Bedford, IN 47421; 812/275-4425
IRI	Industrial Risk Insurers 85 Woodland St.; Hartford, CT 06102; 203/525-2601
ISA	Instrument Society of America P. O. Box 12277; Research Triangle Park, NC 27709; 919/549-8411
LEED	Leadership in Energy and Environmental Design U. S. Green Building Council 1800 Massachusetts Avenue NW, Suite 300 Washington , DC 20036 (800) 795-1747
MCAA	Mechanical Contractors Association of America 5530 Wisconsin Aven.; Chevy Chase, MD 20815 202/654-7960
MIA	Marble Institute of America 33505 State St.; Farmington, MI 48024 313/476-5558
MIL	Military Standardization Documents (U.S. Dept. of Defense) Naval Publications and Forms Center 5801 Tabor Ave.; Philadelphia, PA 19120
ML/SFA	Metal Lath/Steel Framing Association 221 N. LaSalle St.; Chicago, IL 60601 312/346-1600
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry 5203 Leesburg Pike; Falls Church, VA 22041; 703/998-7996
NAAMM	National Association of Architectural Metal Manufacturers 221 N. Lasalle St.; Chicago, IL 60601 312/346-1600
NAPF	National Association of Plastic Fabricators 1701 N. St., NW; Washington, DC 20036; 202/233-2504
NBGQA	National Building Granite Quarries Association c/o H. E. Fletcher Co.; West Chelmsford, MA 01863
NBS	National Bureau of Standards (U.S. Dept. of Commerce) Gaithersburg, MD 20234

	301/921-1000
NCMA	National Concrete Masonry Association P. O. Box 781; Herndon, VA 22070 703/435-4900
NEC	National Electrical Code (by NFPA)
NEII	National Elevator Industry, Inc. 600 Third Aven.; New York, NY 10016 212/986-1545
NECA	National Electrical Contractors Association 7315 Wisconsin Aven.; Bethesda, MD 20814 301/657-3110
NEII	National Elevator Industry, Inc. 600 Third Avenue; New York, NY 10016 212/986-1545
NEMA	National Electrical Manufacturers Association 2101 L St., NW; Washington, DC 20037 202/457-8400
NFPA	National Fire Protection Association Batterymarch Park; Quincy, MA 02269 617/328-9290
NFPA	National Forest Products Association 1619 Massachusetts Aven.; NW; Washington, DC 20036 202/797-5800
NHLA	National Hardwood Lumber Association P. O. box 34518; Memphis, TN 38104; 901/377-1818
NPA	National Particleboard Association 2306 Perkins Pl.; Silver Spring, MD 20910; 301/587-2204
NRCA	National Roofing Contractors Association 8600 Bryn Marr Aven.; Chicago, Il. 60631 312/693-0700
NSF	National Sanitation Foundation P. O. Box 1468; Ann Arbor, MI 48106 313/769-8010
NSSEA	National School Supply and Equipment Association 1500 Wilson Blvd.; Arlington, VA. 22209 703/524-8819
NTMA	National Terrazzo and Mosaic Association 3166 Des Plains Ave.; Des Plains, IL 60018

312/635-7744

NWMA	National Wood Manufacturers Association 205 West Touhy Avenue; Park Ridge, IL 60068; 312/823-6747
OSHA	Occupational Safety Health Administration (U.S. Dept. of Labor) Government Printing Office; Washington, DC 20402
PCI	Prestressed Concrete Institute 20 N. Wacker Dr., Chicago, IL 60606 312/346-4071
PDI	Plumbing and Drainage Institute 5342 Blvd., Pl.; Indianapolis, IN 46208 317/251-5298
PEI	Porcelain Enamel Institute 1911 N. Fort Myer; Arlington, VA 22209 703/527-5257
PS	Product Standard of NBS (U.S. Dept. of Commerce) Government Printing Office; Washington, DC 20402
RFCI	Resilient Floor Covering Institute 1030 15th St.; NW; Washington, DC 20005 202/833-2635
RIS	Redwood Inspection Service (Grading Rules) 627 Montgomery; San Francisco, CA 94111
SAMA	Scientific Apparatus Makers Association 1101 16th St., NW; Washington, DC 20036 202/223-1360
SCAQMD	South Coast Air Quality Management District 21865 Copley Drive Diamond Bar, CA 91765 (909) 396-2000
SDI	Steel Deck Institute P. O. Box 3812; St. Louis, MO 63122 314/965-1741
SDI	Steel Door Institute 712 Lakewood Cnt. N.; Cleveland, OH 44107 216/226-7700
SHLMA	Southern Hardwood Lumber Manufacturers Association 805 Sterick Bld.; Memphis, TN. 38103 901/525-8221
SIGMA	Sealed Insulating Glass Manufacturers Association

	111 E. Wacker Dr.; Chicago, IL. 60601 312/644-6610
SJI	Steel Joist Institute 1703 Parham Rd.; Richmond, VA 23229 804/288-3071
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association P. O. Box 70; Merrifield, VA 22116
SPIB	Southern Pine Inspection Bureau (Grading Rules) 4709 Scenic Hwy.; Pensacola, FL 32504; 904/434-2611
SSPC	Steel Structures Painting Council 4400 5th Avenue; Pittsburgh, PA 15213; 412/578-3327
TCA	Tile Council of America P. O. Box 326, Princeton, NJ 08540; 609/921-7050
TIMA	Thermal Insulation Manufacturers Association 7 Kirby Plaza; Mt. Kisco, NY 10549; 914/241-2284
TPI	Truss Plate Institute 100 W. Church St., Frederick, MD 21701; 301/694-6100
UL	Underwriters Laboratories 333 Pfingsten Rd.; Northbrook, IL 60062; 312/272-8800
WCLIB	West Coast Lumber Inspection Bureau (Grading Rules) P. O. Box 2315; Portland, OR 97223; 503/639-0651
WIC	Woodwork Institute of California 1833 Broadway; Fresno, CA 93773; 209/233-9035
WRI	Wire Reinforcement Institute 7900 Westpark drive; McLean, VA. 22102; 703/790-9790
WSFI	Wood and Synthetic Flooring Institute 2400 E. Devon; Des Plaines, IL 60018; 312/635-7700
WWPA	Western Wood Products Association (Grading Rules) 1500 Yeon Bldg.; Portland, OR 97204; 503/224-3930

WWPA Woven Wire Products Association
 108 W. Lake St.; Chicago, IL 60601;
 312/332-6502

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1 - GENERAL

DESCRIPTION OF WORK:

Extent of demolition is shown on the plans. Refer to all Drawings and project phasing requirements..

Demolition requires the removal and subsequent off-site disposal of the following but is not limited to:

Removal of asphalt or concrete paving, with curb and guttering.

Removal of building structures and structural elements, complete with foundations – including concrete floors/walks and exterior canopies.

Removal of building exterior wall and roof components.

Removal of interior walls and components.

Removal of partitions and doors.

Removal of windows and window walls.

Removal of ceiling systems, floor finishes and wall finishes.

Removal of underground elements and components; piping and accessories.

Removal of plumbing, electrical and mechanical equipment.

Cutting concrete floors, masonry walls and ceilings for piping, ducts, and conduit is included with the work of the respective mechanical and electrical Divisions 15 and 16 Specification Sections.

Locating and identification of existing underground utilities.

SUBMITTALS:

Demolition Schedule: Submit schedule indicating proposed methods and sequence of operations for selective demolition work to Owner's Representative for review prior to commencement of work. Include coordination for shut-off, capping, and continuation of utility services as required, together with details for dust and noise control protection.

Incorporate all selective demolition and abatement operations and phases into the Project CPM Schedule.

Coordinate with Owner's continuing occupation of portions of existing building.

JOB CONDITIONS:

Occupancy: Owner will be continuously occupying the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in a manner that will minimize need for disruption of

Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities which will severely impact Owner's normal operations.

Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.

Protections: Provide temporary barricades and other forms of protection as required to protect personnel and general public from injury due to demolition work.

Provide interior and exterior shoring, bracing or support to prevent movement, settlement, or collapse of structure or element to be demolished, and adjacent facilities or work to remain.

Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.

Protect floors with suitable coverings when necessary.

Construct temporary insulated solid dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks if required.

Provide temporary weather protection, including temporary weather walls, during interval between demolition and removal of existing construction on exterior surfaces, and installation of new construction to insure that no water leakage or damage occurs to structure or interior areas of existing buildings.

Remove protections at completion of work.

Damages: Promptly repair damages caused to adjacent facilities by demolition work at no cost to Owner.

Traffic: Conduct selective demolition operations and debris removal in a manner to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

Do not close, block or otherwise obstruct streets, walks or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

Explosives: Use of explosives will not be permitted.

Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.

Environmental Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.

Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION

INSPECTION:

Prior to commencement of demolition work, inspect areas in which work will be performed. Photograph existing conditions to structure surfaces, equipment or to surrounding properties which could be misconstrued as damage resulting from selective demolition work; file with Owner's Representative prior to starting work.

LOCATING EXISTING UNDERGROUND UTILITIES:

Prior to commencement of groundbreaking work, contractor shall provide for and retain a private utilities locating firm. All underground utilities within the construction limits shall be located, marked and identified by the private utility location service, prior to any ground breaking. All information shall be documented in a contractor's As-Built drawings format.

PREPARATION:

Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

Cease operations and notify the Owner's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

Cover and protect furniture, equipment and fixtures to remain from soiling or damage when demolition work is performed in rooms or areas from which such items have not been removed.

Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to occupied portions of the building.

Where selective demolition occurs immediately adjacent to occupied portions of the building, construct temporary dust-proof partitions of minimum 4" studs, 5/8" drywall (joints taped and mudded) on occupied side, 1/2" fire-retardant plywood on demolition side, and fill partition cavity with sound-deadening insulation.

Provide weatherproof closures for exterior openings resulting from demolition work.

Where ongoing new construction occurs immediately adjacent to occupied portions of the buildings, construct temporary weather-proof partitions of minimum 4" studs, 5/8" drywall (joints taped and mudded) on occupied side, 1/2" fire-retardant plywood, and 1/2" Densglas exterior grade gypsum sheathing with sealed joints, on the construction side, and fill partition cavity with sound-deadening insulation.

Locate, identify, stub off and disconnect utility services that are not indicated to remain.

DEMOLITION:

Perform demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.

Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors or framing.

Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.

If unanticipated mechanical, electrical or structural elements which conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive from Owner's Representative re-arrange selective demolition schedule as necessary to continue overall job progress without delay.

DISPOSAL OF DEMOLISHED MATERIALS:

The Owner reserves salvage rights to equipment and material, items to be determined at pre-construction conference. At request of the Owner, Contractor shall coordinate the scheduled removal of designated material to be salvaged and place said material outside of building, on site, for removal by Owner.

Remove all debris, rubbish and other materials resulting from demolition operations and not salvaged by the Owner from building site. Transport and legally dispose of materials off-site.

Hazardous materials disposal during demolition operations, shall comply with all applicable regulations, laws, and ordinances, concerning removal, handling and protection against exposure or environmental pollution.

Burning of removed materials is not permitted on project sites.

CLEAN-UP AND REPAIR:

Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave interior areas broom clean.

Repair demolition performed in excess of that required. Return structures and surfaces to remain to condition existing prior commencement of demolition work. Repair adjacent construction or surfaces soiled or damaged by demolition work to like new condition.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Extend of site clearing is shown on drawings.

Site clearing work includes, but is not limited to:

- Removal of trees and other vegetation.
- Topsoil stripping and stockpiling.
- Clearing and grubbing.

JOB CONDITIONS:

Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

Protection of Existing Improvements: Provide protection necessary to prevent damage to existing improvements indicated to remain in place.

Protect improvements on adjoining properties and on Owner's property.

Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.

PART 2: PRODUCTS

Not applicable to work of this section.

PART 3: EXECUTION

SITE CLEARING:

General: Remove trees, shrubs, grass and other vegetation, improvements, or obstructions interfering with installation of new construction. Remove such items elsewhere on site or premises as specifically indicated. Removal includes digging out stumps and roots, and backfill with suitable compacted fill material.

Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4". Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2" in diameter, and without weeds, roots, and other objectionable material.

Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.

Remove heavy growths of grass from areas before stripping.

Stockpile a quantity of topsoil to allow a full 3" topsoil layer to be redistributed throughout all finish grade areas.

Stockpile topsoil in storage piles in areas shown, or where directed. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent wind-blown dust.

Dispose of unsuitable or excess topsoil same as waste material, herein specified.

Clearing and Grubbing: Clear site of trees, shrubs and other vegetation, except for those indicated to be left standing.

Removal of Improvements: Remove existing above-grade and below-grade improvements necessary to permit construction, and other work as indicated.

DISPOSAL OF WASTE MATERIALS:

Burning on Owner's Property: Burning is allowed on the Owner's property, with proper permits.

Removal from Owner's Property: Remove waste materials and unsuitable and excess topsoil from Owner's property and dispose of off-site in legal manner.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Extent of earthwork is indicated on drawings.

Earthwork includes all excavation (removal of material) necessary to reach subgrade elevations indicated. This includes subsequent disposal of material. Preparation of subgrade for building pads, parking areas, access roads and storm drainage installation are included as part of this work.

QUALITY ASSURANCE

TESTING AND INSPECTION SERVICE:

All sub-grade and stone base shall be proof-rolled in accordance with NCDOT Standards and as directed by Engineer. Project Engineer shall be present at proof rolling.

CODES AND STANDARDS:

All work conducted as part of this are to be in compliance with NCDOT specifications for Roadway Construction.

SUBMITTALS:

Test Reports-Excavating: Submit following reports directly to Engineer from the testing services, with copy to Contractor:

Field density test reports on all trench backfill located beneath existing or proposed roadways.

JOB CONDITIONS:

Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner and Project Engineer immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.

Provide minimum of 48-hour notice to Engineer, Owner, and Local Government and receive written notice to proceed before interrupting any utility.

Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

Operate warning lights as recommended by authorities having jurisdiction.

Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

PART 2: PRODUCTS

SOIL MATERIALS

DEFINITIONS:

Satisfactory soil materials are defined as those complying with ASTM D 2487 soil classification groups GW, GP, GM, SM, SW and SP.

Drainage Fill: Washed, evenly graded mixture of crushed No. 57 - Stone.

Select Backfill: Job excavated or borrow material of coarse sands, fine sands or sandy clay mixture.

Backfill Materials: Satisfactory Class I through Class VII soil materials free of clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen material, vegetable and other deleterious matter.

Excavation: Removal of material encountered to subgrade elevations and the reuse or disposal of materials removed. Refer to the following section for additional definitions and classified excavations.

Unauthorized Excavation: Removing materials beyond indicated invert/subgrade elevations or dimensions without direction by the design authority, or Owner. Unauthorized excavations, as well as associated remedial work directed by design authority or Owner, shall be at contractor's expense. Backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by design authority.

Subgrade: The uppermost surface of an excavation (after stripping is fully complete) or the top surface of a new fill or backfill immediately below base course, drainage course, walks, drainage fill, slab base materials, or topsoil materials.

Borrow: Suitable soil materials obtained from off-site when sufficient approved soil material is not available from on-site excavations.

Surface Course: The top layer of the pavement structure placed on aggregate base course, asphalt base course, or subgrade, as required.

Aggregate Base Course: Aggregate material layer placed between the subgrade elevation and asphalt paving course, meeting the requirements of Section 910-1, Paragraph (a) of "Standard Specifications for Roads and Structures" by NCDOT.

Bedding Course: Layer placed over excavated subgrade in trench bottoms before laying pipe.

Structures: Buildings, footings, foundations, retaining walls, slabs-on-grade, curbs, tanks, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

UNIT PRICES

Rock Measurement: Volume of rock actually removed, measured in original position, but not exceeding the following:

1. 24 inches outside of concrete forms other than at footings.
2. 12 inches outside of concrete forms at footings.
3. 6 inches outside of minimum required dimensions of concrete cast against grade.
4. 6 inches beneath bottom of concrete slabs-on-grade.
5. 6 inches beneath bottom of footings.
6. 6 inches beneath invert elevation of pipe and/or related structures in trenches, and the greater of 24 inches wider than outside pipe diameter, or 42 inches wide (regardless of trench box sizes). 24 inches wider than related structures in trenches.

Unsuitable Soil Measurement: Volume of unsuitable soil actually removed below subgrade elevations (as recommended and classified by Owner's Geotechnical Testing Firm) measured in-place, but not exceeding the following:

1. 24 inches outside of concrete forms other than at footings.
2. 12 inches outside of concrete forms at footings.
3. 6 inches outside of minimum required dimensions of concrete cast against grade.
4. 12 inches beneath invert elevation of pipe and/or related structures in trenches, and the greater of 24 inches wider than outside pipe diameter, or 42 inches wide (regardless of trench box sizes). 24 inches wider than related structures in trenches.
5. Minimum dimensions as recommended by Owner's Geotechnical Testing Firm in any other areas.

Unit prices for unsuitable soil and rock removal shall include all work and materials as defined in Division 1 Sections, including any required replacement with suitable fill soils or other materials, as required.

Structural Geo-Grids: Integrally Formed Biaxial Geogrid for base reinforcement and subgrade improvement formed with polypropylene polymer in roll form providing positive mechanical interlock. Provide Tensar BX1100 Geogrid.

PART 3: EXECUTION

EXCAVATION CLASSIFICATIONS:

Excavation Classifications: All excavation is classified as General Excavation except for Mass Rock, Trench Rock and Unsuitable Soil Materials as defined in this section.

General Excavation: Excavation, removal and/or disposal of pavements and other obstructions visible on surface, underground structures, utilities, and other items indicated to be demolished and/or removed; together with soil, boulders, and other materials encountered that are not classified as Mass Rock, Trench Rock, Unsuitable Soil, or unauthorized excavation.

- a. Intermittent drilling, ripping or blasting to increase production and not necessary to permit excavation of materials encountered will be considered general excavation.
- b. Soil (irregardless of nature) or other debris encountered above plan subgrade elevations shall be considered general excavation unless determined by the Owner's Geotechnical Testing Firm to meet the definition of Mass Rock.

Unsuitable Soil Excavation: Removal and disposal of soil materials or other debris encountered at or below plan subgrade elevations, which are deemed unsuitable to remain in place by the owner's Geotechnical Testing Firm or design authority.

- a. Soil and/or other debris encountered above plan subgrade shall be considered general excavation.
- b. Soil material which, in the opinion of the Owner's Geotechnical Testing Firm, can be repaired by scarifying, drying or moistening, and recompacting, or material which is made unsuitable by delay of work, lack of protection, inclement weather, or other actions of the Contractor or their Sub-Contractors shall not be considered as unsuitable soil and shall be repaired or replaced by the contractor at no additional cost to the Owner.
- c. Any material moved or removed without the prior classification, measurement and approval by the Owner's Geotechnical Testing Firm or design authority will be considered as general excavation.

Mass Rock Excavation: Removal of a rock formation within an open excavation that (1) is a boulder larger than 1.5 cubic yards in one piece, or (2) cannot be excavated without systematic drilling and blasting. In the event Mass Rock (as defined above) is encountered, the Contractor shall demonstrate (at no additional cost to the owner) to the Owner's Geotechnical Testing Firm that the rock cannot be ripped with equipment equivalent to the following size and performance ratings, without systematic drilling and blasting.

- a. Mass Rock Excavation Equipment: Late-model, track-type tractor rated at not less than 270 hp flywheel power with a draw bar pull of 65,000 lbs at 1 mph in the lowest available gear, and the highest normal operating rpm pulling a sharp, single-toothed shank ripper. The equipment operator should be adequately qualified and experienced with ripping rock with this type equipment.

Trench Rock Excavation: Removal of a rock formation within a trench excavation that (1) is a boulder larger than 1.0 cubic yards in one piece, or (2) cannot be excavated by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling and blasting.

- a. Trench Rock Excavation Equipment: Late-model, track mounted hydraulic excavator equipped with a 42-inch wide (or smaller), short tip-radius bucket with rock teeth; rated at not less than 120-hp flywheel power with a pull of not less than 36,500-lb at a rate of 10 cubic yards per hour. The equipment operator should be adequately qualified and experienced with excavating rock with this type equipment.

Classified Excavation Requirements:

- a. Excavations more than 10 feet in width and pits more than 30 feet in either length or width are defined as open excavations.
- b. Contractor shall expose and clean the surface and any exposed areas of the rock material for classification and measurement (in-place) by the Owner's Geotechnical Testing Firm.
- c. Do not excavate rock or unsuitable soil until it has been classified and measured by the Owner's Geotechnical Testing Firm. Any material moved or removed without the prior classification and measurement by the Owner's Geotechnical Testing Firm will be considered as unclassified excavation.
- d. The Owner or the Owner's Geotechnical Testing Firm shall be the final judge on what is classified as Mass Rock, Trench Rock, or Unsuitable Soils.
- e. The contractor may be required to provide equipment specification data verifying that the above minimum-rated equipment will be used for demonstration purposes. The equipment shall be in good repair and proper working condition. The contractor may be required to provide verification of the equipment operator's qualifications and experience operating the noted equipment for rock removal purposes.
- f. Rippable rock, weathered rock, partially weathered rock, soft rock, or hard overburden soil, which is not classified as Mass Rock or Trench Rock according to the above definitions, shall be considered unclassified excavation.

EXCAVATION AND BACKFILL:

Roadway Excavation: Excavation for the roadways, drives, and parking areas shall conform to the lines, grades, cross sections, and dimensions indicated on the drawings and shall include the excavation of all unsuitable materials from the subgrade. Subgrade shall conform to proposed line, grade and cross-section. This operation shall include any reshaping and wetting or drying required to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with suitable material.

Proof Rolling and Undercut Excavation: When excavation has reached required subgrade elevations, provide a proof rolling of the prepared pavement subgrade with a loaded tandem axle dump truck (+25 tons) in the presence of the Owner's Geotechnical Testing Firm. The proof rolling shall be covered by the wheels of the proof rolling vehicle operating at a speed between 2 and 3 miles per hour.

Any areas that rut or pump excessively shall be allowed to dry or shall be undercut and backfilled with select material as directed by the Owner's Geotechnical Testing Firm.

After undercut and backfill operations are complete, a final proof rolling of the undercut areas will be performed in the presence of the Owner's Geotechnical Testing Firm.

Additional Excavation: When excavation has reached required invert/subgrade elevations, notify the Owner's Geotechnical Testing Firm, who will make an inspection of conditions.

Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

Do not allow water to accumulate in excavations. Remove water to prevent softening of excavation bottoms. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

Excavation for Pavement: Cut surface directly beneath proposed pavement to comply with cross-sections, elevations and grades as shown.

CONTRACTOR IS TO CONTACT NC ONE CALL 48 HOURS PRIOR TO ANY EXCAVATION. CONTRACTOR SHOULD UNDERSTAND THAT ONCE EXISTING UTILITIES ARE LOCATED THAT SAID LOCATION IS VALID ONLY FOR TEN DAYS.

Should it be necessary to cut pavement or otherwise work within a public street, the North Carolina Department of Transportation is to be contacted prior to work, and applicable permits obtained.

TRENCH BACKFILL:

Excavation, bedding, haunching & backfilling shall conform to Section 02210 TRENCHING AND BACKFILLING FOR UTILITIES and Drawings.

Width of trenches at any point below top of pipe shall not be greater than outside diameter of pipe plus 16" for pipes measuring up to 30", and 24" for pipe measuring greater than 30", to permit satisfactory jointing and thorough tamping of bedding material under and around pipe. Care shall be taken not to over-excavate.

Bedding surface for pipe shall provide a firm foundation of uniform density throughout entire length of pipe. Carefully bed pipe in a sand or stone material foundation as specified, that has been accurately shaped and rounded to conform to lowest 1/4 of outside portion of circular pipe, or lower curved portion of pipe arch for entire length of pipe or arch. When necessary, tamp bedding firmly. Bell holes and depressions for joints shall be only of such length, depth, and width as required for properly making particular type joint.

Bed pipe located under pavement or building footprints in a sand or stone material foundation as specified and as indicated on Drawings.

Existing utility lines shall be protected from damage during excavation and backfilling, and, if damaged, shall be repaired by the Contractor at his expense. In the event that the Contractor damages any existing utility lines, he shall report thereof immediately. If it is determined that repairs shall be made by the Contractor, such repairs shall be ordered under terms of other sections of these specifications.

After bedding has been prepared and pipe installed, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6" in compacted depth. Bring backfill up evenly on both sides of pipe for its full length. Care shall be taken to ensure thorough compaction of fill under haunches of pipe. Thoroughly compact each layer to an elevation of at least 12" above top of pipe. Backfill and compact remainder of trench by spreading and rolling, or compact by mechanical rammers or tampers in layers not exceeding 8".

After bedding has been prepared and pipe installed for locations under pavement and building footprints, backfill and compact remainder of trench with selected Type III or IV material from excavation or borrow.

In compacting or rolling or operating heavy equipment parallel with pipe, displacement of or injury to pipe shall be avoided. Any pipe damaged thereby shall be repaired or replaced, at option of Engineer, and at expense of the Contractor.

When fill or backfill is required to be compacted to any specified density factor, tests shall be executed by an approved laboratory to ascertain compliance with requirements, at the expense of the Owner through the established Testing Allowance. One test shall be made for each 50 linear feet of open trench. Cost of laboratory services shall be borne by the Contractor as a part of costs for this section of work for any repeat tests for any specific area which fails to meet requirements.

Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F (1 degree C).

GENERAL BACKFILL:

Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.

In excavations, use satisfactory excavated or borrow material.

Under grassed areas, use satisfactory excavated or borrow material.

Under walks and pavements, use subbase material, or satisfactory excavated or borrow material, or combination of both.

Backfill excavations as promptly as work permits, but not until completion of the following: Inspection, testing, approval, and recording locations of underground utilities.

Ground Surface Preparation: 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 horizontals so that fill material will bond with existing surface.

When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

Placement and Compaction: Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand-operated tampers.

Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content.

Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

Place backfill and fill materials evenly adjacent to structures, piping or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

COMPACTION:

General: Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.

Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture density relationship (cohesive soils) determined in accordance with ASTM D 698;

Structures, Building Slabs and Steps: Compact each layer of backfill or fill material at 95 % maximum density for cohesive material or 98 % for cohesionless material to within 2' of surface. From 2' deep to finish grade, compact 98% maximum density for cohesive material or 100% relative density for cohesionless material.

Pavements: Compact each layer of backfill or fill material at 95% maximum dry density to within 6" of surface. From 6" deep to finish grade, compact to 100% maximum density in accordance with AASHTO-T99.

Lawn or Unpaved Areas: Compact top 6" of subgrade and each layer of backfill or fill material at 85% maximum density for cohesive soils and 90% relative density for cohesionless soils.

Walkways: Compact top 6" of subgrade and each layer of backfill or fill material at 90% maximum density for cohesive material or 95% relative density for cohesionless material.

Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

GRADING:

General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

Grade areas as shown on the Drawings to prevent ponding. Finish surface free from irregular surface changes, and as follows:

Lawn or Unpaved Areas: Finish areas to receive a minimum of 3" layer topsoil to within not more than 0.10' above or below required sub-grade elevations.

Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.05' above or below required subgrade elevation.

Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2" above or below required subgrade elevation.

Patches in driveways and roadways shall be graded to depth required to match existing pavement or to provide minimum pavement specified.

Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

PAVEMENT SUBBASE COURSE:

General: Subbase course consists of placing subbase material, in layers of specified thickness, over subgrade surface to support a pavement base course.

Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.

Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least a 12" width of shoulder simultaneously with compacting and rolling of each layer of subbase course.

Placing: Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.

When a compacted subbase course is shown to be 6" thick or less, place material in a single layer. When shown to be more than 6" thick, place material in equal layers, except no single layer more than 6" or less than 3" in thickness when compacted.

FIELD QUALITY CONTROL:

Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.

If in opinion of Engineer, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

MAINTENANCE:

Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

DISPOSAL OF EXCESS AND WASTE MATERIALS:

Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of off Owner's property.

Comply with and coordinate with the project Construction Waste Management Plan (CWMP).

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1 - GENERAL

- 1.1 DESCRIPTION: Perform site preparations, excavation, and backfilling of all materials encountered and to the depths required to complete the work as shown on the Drawings.
- 1.2 EXISTING CONDITIONS: Every reasonable effort has been made to provide accurate information on existing site conditions. The Contractor should become familiar with the site and satisfy himself as to the scope of work involved and the materials to be encountered. Any significant change in conditions should be immediately brought to the attention of the Owner's representative.

PART 2 - MATERIALS

2.1 SOILS

- 2.1.1 General: Use soils free of organic matter, refuse, rocks and lumps greater than 4 inches in diameter and other deleterious matter.
- 2.1.2 Classification: For the purpose of this specification, soils to be used as fill material are grouped into seven classes according to soil properties and characteristics.

Class I	Clean gravel complying with ASTM C33, coarse aggregate No. 57.
Class II	Clean sand complying with ASTM C33, fine aggregate.
Class III	Clean gravels and sands complying with ASTM D2487, Types GW, GP, SW, and SP.
Class IV	Soil mixtures complying with ASTM D2487, Types GM, GC, SM, & SC.
Class V	Soil mixtures complying with ASTM D2487, Types ML and CL.
Class VI	Soil mixtures complying with ASTM D2487, Types MH and CL.
Class VII	Organic soil mixtures complying with ASTM D2487, Types OL, OH & PT.

PART 3 – EXECUTION

3.1 GENERAL

- 3.1.1 Familiarization: Prior to commencement of the earthwork, become thoroughly familiar with the site, the site conditions, and all portions of the work specified in this Section.
- 3.1.2 Approvals: Backfilling and grading operations shall not commence until all required inspections, tests and approvals have been completed. Work covered prior to inspection shall be uncovered for inspection purposes and backfilled at no additional cost to the Owner.

SURFACE PREPARATION

- 3.1.1 Clearing: Areas designated for clearing and required for construction operations shall be cleared of trees, brush, structures and other materials. Trees that are to remain shall be protected during clearing operations and subsequent work.
- 3.1.2 Grubbing: Roots, stumps and other materials shall be grubbed from the cleared areas to a depth of at least 18 inches. Tree stumps shall be grubbed in their entirety, including taproots where applicable.
- 3.1.3 Topsoil: Strip existing topsoil to a depth of 4 inches from areas to be excavated or graded. Stockpile the topsoil in a suitable area for use during final grading operations. Protect the topsoil from erosion.
- 3.1.4 Unsuitable Material: Remove sod, muck or other unsuitable material to firm subsoil in areas designated for filling or grading operations.
- 3.1.5 Disposal: Trees, stumps, roots, rubbish, unsuitable soil or other material resulting from surface preparation shall be removed from the site by the Contractor and disposed of.

3.2 EXCESS WATER CONTROL:

- 3.2.1 General: Grade and maintain all areas of the site to preclude surface runoff into excavations and prevent ponding of water.
- 3.2.2 Dewatering: Excavations shall be kept free of surface water and/or groundwater. Provide and maintain at all times the necessary means and devices to prevent water from entering the excavations and for removing all water entering the excavations.

3.3 TRENCHING, BACKFILLING AND COMPACTION FOR UTILITY SYSTEMS

- 3.3.1 General: Refer to specific utility sections in these Specifications for installation requirements. Trench, backfill, and compact as specified except as modified herein.
- 3.3.2 Trenching: Trench widths at and below the top of the pipe shall be the minimum necessary for proper installation. Trench banks above the top of the pipe shall be as vertical as practicable. Over-depth excavation shall be backfilled with suitable bedding material and compacted. The Contractor shall provide, at his expense and as directed by the Owner's representative, special bedding material or concrete encasement as may be necessary due to over excavation.
- 3.3.3 Depth: Trench to the lines and grades shown on the drawings. Where elevations are not shown, trench to depth sufficient to provide at least 36 inches of cover above the top of pipe, unless otherwise specified. Grade trenches to provide a constant slope free of sags and high spots.
- 3.3.4 Trench Bracing: Properly brace, sheet and support trench walls in strict conformance with all pertinent laws and regulations. Provide adequate bracing and shoring to protect adjacent improvements.
- 3.3.5 Bedding, Haunching, and Initial Backfill: Tamp subgrade to provide firm, even bedding. Excavate bedding material to match the shape of the bottom of the pipe and bell, as detailed in the Drawings. Place haunching material so as to provide full bearing around the bottom of the pipe. Haunching and initial backfill shall be Class I, II, III, or IV placed in 12 inch maximum lifts to a level 12 inches above the top of pipe and compacted to a minimum 95 percent Standard Proctor by the AASHTO - T99 method.
- 3.3.6 Backfill: Backfill the remainder of the trench in accordance with the paragraphs below:

- 3.3.6.1 Pavement Areas: Compact the subgrade and fill material beneath paved areas and shoulders to a minimum 95 percent Standard Proctor by the AASHTO-T99 method. Compact top 6" of subgrade to 100 percent Standard Proctor by the AASHTO-T99 method.
- 3.3.6.2 Landscaped Areas: Compact the subgrade and fill to a minimum 90 percent standard proctor by the AASHTO-T99 method.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Provide soil treatment for termite control, as herein specified.

QUALITY ASSURANCE:

In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work, including preparation of substrate and application.

Engage a professional pest control operator, licensed in accordance with regulations of governing authorities for application of soil treatment solution.

JOB CONDITIONS:

Restrictions: Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.

To insure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

SUBMITTALS:

Product Data: Submit manufacturer's technical data and application instructions.

SPECIFIC PRODUCT WARRANTY:

Furnish written warranty certifying that applied soil poisoning treatment will prevent infestation of subterranean termites and, that if subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation.

Provide warranty for a period of 5 years from date of treatment, signed by Applicator and Contractor.

PART 2: PRODUCTS

SOIL TREATMENT SOLUTION:

The pest control operator will submit the Safety Data Sheet and label of the termiticide he will use on the project. The termiticide must be currently approved as a termiticide by the N. C. Structural Pest Control Committee.

PART 3: EXECUTION

APPLICATION:

Surface Preparation: Remove foreign matter which could decrease effectiveness of treatment on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placement of compacted fill under slabs, if recommended by toxicant manufacturer.

All treatments (excluding the rate of application and treating techniques) must be performed as outlined on the termiticide's label.

All treatments in regards to rate of application and treatment technique will be performed as outlined in the N. C. Structural Pest Control Committee's Rules and Regulations as currently applies to treatment of commercial buildings under construction.

All treatments performed pursuant to Rule. -506 shall be performed at the label recommended rate and concentration only.

Minimum Treatment Requirements:

1. Establish a vertical barrier in the soil along inside of the main foundation wall; the entire perimeter of all multiple masonry chimney bases, pillars, pilasters, and piers; and both sides of partition or inner walls with a termiticide from the top of the grade to the top of the footing.
2. After a building or structure has been completed and the excavation filled and leveled, so that the final grade has been reached along the outside of the main foundation wall, establish a vertical barrier in the soil adjacent to the outside of the main foundation wall with a termiticide from the top of the grade to the top of the footing, according to the label; except that, where drain tile, trench drains or other foundation drainage systems present a hazard of contamination outside the treatment zone, treatment shall be performed in a manner that will not introduce termiticide into the drainage system.
3. Establish a horizontal barrier in the soil within 3' of the main foundation, under slabs, such as patios, walkways, driveways, terraces, gutters, etc. Treatment shall be performed before slab is poured, but after fill material or fill dirt has been spread.
4. Establish a vertical barrier in the soil around all critical areas, such as expansion and construction joints and plumbing and utility conduits, at their point of penetration of the slab of floor or, for crawl space construction, at the point of contact with the soil.

Reapply soil treatment solution to areas distributed by subsequent excavation or other construction activities following application.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1:

DESCRIPTION OF WORK:

The work required is that necessary to conduct the construction in accordance with the requirements the North Carolina Sedimentation Pollution Control Act of 1973 and the rules and regulations promulgated pursuant to the provisions of said act.

Related Work Specified Elsewhere:

Fertilizing, Seeding and Mulching: Section 02480

Codes and Standards: North Carolina Sedimentation Pollution Control Act of 1973 and the Rules and Regulations promulgated pursuant to the provisions of said act.

Local County Soil Erosion and Sedimentation Control Ordinance.

In the event of conflict between the regulations listed above and the requirements of these specifications, the more restrictive requirements shall apply.

PART 2: PRODUCTS

PART 3: EXECUTION

GENERAL:

Construct temporary and permanent erosion control measures as shown on the plans and as directed by the Engineer. All permanent erosion control work shall be incorporated into the project at the earliest practicable time. Temporary erosion control measures shall be coordinated with permanent erosion control measures and all other work on the project to assure economical, effective, and continuous erosion control throughout the construction and post construction period and to minimize siltation of rivers, streams, lakes, reservoirs, other water impoundments, ground surfaces, or other property.

The Contractor shall finish grade all disturbed areas and disc the ground surface upon completion of the grading.

The finish grading shall be acceptable to the Owner.

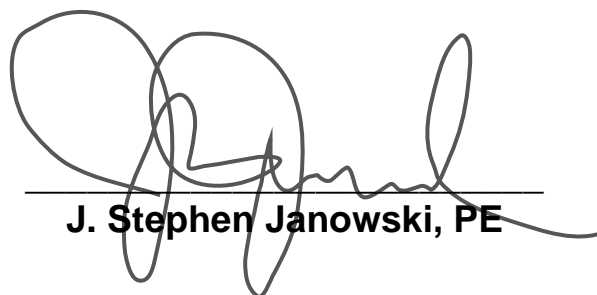
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SOIL EROSION AND SEDIMENTATION CONTROL PLAN NARRATIVE

**THANKSGIVING ELEMENTARY SCHOOL
JOHNSTON COUNTY, NORTH CAROLINA**

FEBRUARY, 2020



J. Stephen Janowski, PE

I. PROJECT DESCRIPTION

This project site consists of approximately 39 acres off of Lynch Road in Johnston County. The site has moderate to steep slopes with the elevation ranges from approximately 282 feet to 234 feet. A combination of stormwater collection and sheet runoff will be utilized. The project consists of school buildings, parking lots and playgrounds.

The temporary stockpile will have 1.5 to 1 side slopes and be for topsoil. It will be redistributed and the remainder permanently seeded. Upon the completion of the spread of topsoil it will be permanently seeded.

This site contains approximately 40 acres of which approximately 36 acres will be disturbed.

II. SITE DESCRIPTION

The site has slopes averaging 2% to 6%. Overall, elevations vary from a high point of 282 feet above sea level to a low point of 234 feet above sea level. The soil types on the site are primarily Gilead Sandy Loam (GeB), Marlboro Sandy Loam (MaA,B), Marlboro Cecil complex (McB).

III. ADJACENT PROPERTY

The property is bounded on the east by NCSR 1576 and on the south by commercial property, the north and west by undeveloped property.

IV. SOILS

According to the soil survey from the USDA the soil types on the site are Gilead Sandy Loam (GeB), Marlboro Sandy Loam (MaA,B), Marlboro Cecil complex (McB).

V. PLANNED STORM WATER MANAGEMENT AND EROSION AND SEDIMENTATION CONTROL MEASURES

- **TEMPORARY GRAVEL CONSTRUCTION ENTRANCE**

A Temporary Gravel Construction Entrance is to be used at all street connections.

- **TEMPORARY SILT FENCE**

Temporary Silt Fences are to be placed at the toe of fill sites adjacent to the property line to collect sediment laden runoff. The silt fence will provide an excellent barrier to protect off-site facilities from sediments.

- **TEMPORARY ROCK CHECK DAMS AND COMPOST SOCK**

Install temporary rock check dams and compost socks as shown on the plans to control erosion and sedimentation in ditches and swales. Temporary check dams and compost socks are to be removed once grading has been completed and permanent ground cover has been established.

- **GRASS LINED CHANNEL**

Grass lined channels with temporary matting will be constructed at locations shown on plans.

- **TEMPORARY SKIMMER TRAP**

These devices will serve to prevent detain sediment-laden runoff and protect receiving streams, drainage systems, and adjacent property. These structures will be inspected after each period of significant rainfall and sediment will be removed and the trap restored to its original dimensions when sediment is found to have accumulated to one half of the design depth of the trap

- **TEMPORARY SKIMMER BASIN WITH RISER AND BARREL**

This device will serve to prevent detain sediment-laden runoff and protect receiving streams, drainage systems, and adjacent property. This structure will be inspected after each period of significant rainfall and sediment will be removed and the trap restored to its original dimensions when sediment is found to have accumulated to one half of the design depth of the trap.

VI. CONSTRUCTION SCHEDULE

Phase 1 Initial Clearing and Grubbing Phase

1. OBTAIN PLAN APPROVALS AND ALL APPLICABLE PERMITS.
2. FLAG LIMITS OF ROUGH GRADING FOR BUILDING SITE, PARKING LOTS AND ESTABLISH GRADE LIMITS AS NEEDED.
3. CONTACT LAND QUALITY SECTION AT 919-791-4200 THEN HOLD PRECONSTRUCTION MEETING WITH GRADING CONTRACTOR, EROSION CONTROL ADMINISTRATOR, PROJECT ENGINEER AND OWNER BEFORE WORK BEGINS.
4. INSTALL TEMPORARY GRAVEL CONSTRUCTION ENTRANCE.
5. INSTALL THE PERIMETER SEDIMENT FENCES AS THE FIRST CONSTRUCTION ACTIVITY PRIOR TO SITE. CLEAR ONLY ENOUGH TO INSTALL SILT FENCE, TEMPORARY SKIMMER BASINS AND DIVERSIONS IN THE WOODED AREA.
6. INSTALL TEMPORARY SKIMMER BASINS AND DIVERSIONS. DISPOSE OF SOIL IN THE TEMPORARY STOCK PILE. CLEAR ONLY ENOUGH TO INSTALL MEASURES AND STABILIZE IMMEDIATELY

Phase 2 Site Grading and Stabilization

1. STRIP SITE OF TOPSOIL AND INSTALL IN THE DESIGNATED AREA
2. BEGIN IMPORTING FILL FOR THE CONSTRUCTION OF THE BUILDING PAD AND DRIVE AREAS.
3. AT TOP OF FILL SLOPES INSTALL TEMPORARY BERMS AND SLOPE DRAINS WITH OUTLET PROTECTION.
4. INSTALL STORM DRAINAGE PIPING AND END OF DAY MEASURES.
5. INSTALL CONCRETE WASHOUT AREA PRIOR TO CONSTRUCTION OF STORM DRAINAGE STRUCTURES.
6. INSTALL INLET PROTECTION AROUND CATCH BASINS AND DROP INLETS AND INSTALL RIP RAP PROTECTION AND ENERGY DISSIPATORS.
7. FINAL GRADE THE BUILDING PADS AND ATHLETIC FIELDS INSTALL GRAVEL AND CURB AND GUTTER IN PREPARATION FOR LAYDOWN AREA.
8. FINE GRADE AND PAVE SIDEWALK, DRIVEWAY AND PARKING LOTS AND LAY DOWN GRAVEL FOR GRAVEL FIRE LANE.
9. PROVIDE A GROUND COVER (TEMPORARY OR PERMANENT) ON EXPOSED SLOPES 14 CALENDAR DAYS FOLLOWING COMPLETION OF ANY PHASE OF GRADING FOR SLOPES 3:1 OR FLATTER INCLUDING ALL OTHER SLOPES 4:1 OR FLATTER. PROVIDE A GROUND COVER (TEMPORARY OR PERMANENT) ON EXPOSED SLOPES WITHIN 7 CALENDAR DAYS FOLLOWING COMPLETION OF ANY PHASE OF GRADING FOR SLOPES 3:1 OR STEEPER INCLUDING ALL PERMANENT DIKES, SWALES, DITCHES AND SLOPES AND DISTURBANCES WITHIN HIGH QUALITY WATER (HQWQ) ZONES.
10. ADDITIONAL EROSION AND SEDIMENTATION CONTROL MEASURES MAY BE REQUIRED BY THE STATE OR OWNER IF DEEMED NECESSARY.
11. MAINTAIN PERMANENT VEGETATION BY TOP DRESSING WITH 700 LBS PER ACRE OF FERTILIZER EVERY 6 MONTHS UNTIL THE COMPLETION OF THE PROJECT.
12. WITHIN 6" OF FINAL GRADE, RE-DISTRIBUTE 6" OF TOP SOIL
13. FINE GRADE, PERMANENTLY SEED AND MULCH ALL LANDSCAPED AREAS
14. REMOVE ALL REMAINING TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES UPON COMPLETION AND STABILIZATION OF PROJECT.

VII. MAINTENANCE PLAN

1. All erosion and sediment control practices will be checked for stability and operation following every run-off producing rainfall but in no case less than once every week. Any needed repairs will be made immediately to maintain all practices as designed.
2. Sediment will be removed from behind the silt fence when it becomes 0.5 feet deep.
3. Sediment will be removed from the sediment trap when the storage has been approximately 50% filled. Gravel will be cleaned and replaced when the sediment pool no longer drains properly.
4. All seeded areas will be fertilized, re-seeded as necessary, and mulched according to specifications in the vegetative plan to maintain a vigorous, dense vegetative cover.

VIII. VICINITY PLAN

See Erosion Control Plan

IX. VEGETATION PLAN

See Construction Drawings

X. GROUND STABILIZATION (PER NCG010000)

1. Soil stabilization shall be achieved on any area of a site where land-disturbing activities have temporarily or permanently ceased according to the following schedule:
 - a. All perimeter dikes, swales, ditches, perimeter slopes and all slopes steeper than 3 horizontal to 1 vertical (3:1) shall be provided temporary or permanent stabilization with ground cover as soon as practicable but in any event within 7 calendar days from the last land-disturbing activity.
 - b. All other disturbed areas shall be provided temporary or permanent stabilization with ground cover as soon as practicable but in any event within 14 calendar days from the last land-disturbing activity.
2. Conditions - In meeting the stabilization requirements above, the following conditions or exemptions shall apply:
 - a. Extensions of time may be approved by the permitting authority based on weather or other site-specific conditions that make compliance impracticable.
 - b. All slopes 50' in length or greater shall apply the ground cover within 7 days except when the slope is flatter than 4:1. Slopes less than 50' shall apply ground cover within 14 days except when slopes are steeper than 3:1, the 7 day-requirement applies.
 - c. Any sloped area flatter than 4:1 shall be exempt from the 7-day ground cover requirement.
 - d. Slopes 10' or less in length shall be exempt from the 7-day ground cover requirement except when the slope is steeper than 2:1.
 - e. Although stabilization is usually specified as ground cover, other methods, such as chemical stabilization, may be allowed on a case-by-case basis.
 - f. For portions of projects within one mile and draining to trout waters and High Quality Waters as classified by the Environmental Management Commission, stabilization with ground cover shall be achieved as soon as practicable but in any event on all areas of the site within 7 calendar days from the last land-disturbing act.
 - g. For portions of projects located in Outstanding Resource Waters watersheds as classified by the Environmental Management Commission, stabilization with ground cover shall be achieved as soon as practicable but in any event on all areas within 7 calendar days from the last land-disturbing act.
 - h. Portions of a site that are lower in elevation than adjacent discharge locations and are not expected to discharge during construction may be exempt from the temporary ground cover requirements if identified on the approved E&SC plan or added by the permitting authority.

XI. SELF INSPECTION AND REPORTING REQUIREMENTS (PER NCG010000)

Minimum self-inspection and reporting requirements are as follows unless otherwise approved in writing by the Division of Water Quality.

1. A rain gauge shall be maintained in good working order on the site unless another rain monitoring device has been approved by the permitting authority.
2. A written record of the daily rainfall amounts shall be retained and all records shall be made available to DWQ or authorized agent upon request (Note: if no rainfall occurred, the permittee must record "zero").
3. Erosion and sedimentation control measures shall be inspected to ensure that they are operating correctly. Inspection records must be maintained for each inspection event and for each measure. At a minimum, inspection of measures must occur at the frequency indicated below:
 - a. All erosion and sedimentation control measures must be inspected by or under the direction of the permittee at least once every seven calendar days, and
 - b. All erosion and sediment control measures must be inspected by or under the direction of the permittee within 24 hours after any storm event of greater than 0.50 inches of rain per 24 hour period.
 - c. Times when a determination that adverse weather conditions prevented inspections should be documented on the Inspection Record.
4. Once land disturbance has begun on the site, stormwater runoff discharge outfalls shall be inspected by observation for erosion, sedimentation and other stormwater discharge characteristics such as clarity, floating solids, and oil sheens. Inspections of the outfalls shall be made at least once every seven calendar days and within 24 hours after any storm event of greater than 0.50 inches of rain per 24 hour period.
5. Inspections are only required to be made during normal business hours. When adverse weather conditions would cause the safety of the inspection personnel to be in jeopardy, the inspection can be delayed until it is deemed safe to perform these duties. If the inspection cannot be done on that day, it must be completed on the following business day.
6. Twenty-four Hour Reporting for visible sediment deposition
 - a. The permittee shall report to the Division of Water Quality central office or the appropriate regional office any visible sediment being deposited in any stream or wetland or any noncompliance which may endanger health or the environment. (See Section IX of this permit for contact information.) Any information shall be provided orally or electronically within 24 hours from the time the permittee became aware of the circumstances. Visible discoloration or suspended solids in the effluent should be recorded on the Inspection Record as provided below.
 - b. A written submission shall be provided to the appropriate regional office of the DWQ within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the sediment deposition and actions taken to address the cause of the deposition. The Division of Water Quality staff may waive the requirement for a written report on a case-by-case basis.
7. Records of inspections made during the previous 30 days shall remain on the site and available for agency inspectors at all times during normal working hours, unless the permitting authority provides a site-specific exemption based on unique site conditions that make this requirement not practical. Older records must be maintained for a period of one year after project completion and made available upon request. The records must provide the details of

- each inspection including observations, and actions taken in accordance with this permit. The permittee shall record the required rainfall and monitoring observations on the "Inspection Record for Activities Under Stormwater General Permit NCG010000" form provided by the Division or a similar inspection form that is inclusive of all of the elements contained in the Division's form. Electronic storage of records will be allowed if approved by the permitting authority.
8. Inspection records must include, at a minimum, the following:
- a. Control Measure Inspections: Inspection records must include at a minimum:
 1. identification of the measures inspected,
 2. date and time of the inspection,
 3. name of the person performing the inspection,
 4. indication of whether the measures were operating properly,
 5. description of maintenance needs for the measure,
 6. corrective actions taken and
 7. date of actions taken.
 - b. Stormwater Discharge Inspections: Inspection records must include at a minimum:
 1. identification of the discharge outfall inspected,
 2. date and time of the inspection,
 3. name of the person performing the inspection,
 4. evidence of indicators of stormwater pollution such as oil sheen, floating or suspended solids or discoloration,
 5. indication of visible sediment leaving the site,
 6. actions taken to correct/prevent sedimentation and
 7. date of actions taken.
 - c. Visible Sedimentation Found Outside the Site Limits: Inspection records must include:
 1. an explanation as to the actions taken to control future releases,
 2. actions taken to clean up or stabilize the sediment that has left the site limits and
 3. the date of actions taken.
 - d. Visible Sedimentation Found in Streams or Wetlands: All inspections should include evaluation of streams or wetlands onsite or offsite (where accessible) to determine if visible sedimentation has occurred.
9. Visible Stream Turbidity - If the discharge from a site results in visible stream turbidity, inspection records must record that evidence and actions taken to reduce sediment contributions. Sites discharging to streams named on the state's 303(d) list as impaired for sediment-related causes may be required to perform additional monitoring, inspections or application of more-stringent management practices if it is determined that the additional requirements are needed to assure compliance with the federal or state impaired-waters conditions. If a discharge covered by this permit enters a stream segment that is listed on the Impaired Stream List for sediment-related causes, and a Total Maximum Daily Load (TMDL) has been prepared for those pollutants, the permittee must implement measures to ensure that the discharge of pollutants from the site is consistent with the assumptions and meets the requirements of the approved TMDL. The DWQ 303(d) list can be found at: http://h2o.enr.state.nc.us/tmdl/General_303d.htm/

XII. EROSION AND SEDIMENTATION CONTROL DEVICES

- All erosion and sedimentation control devices shall remain in place and be maintained by the Contractor until all seeding is established and construction areas have been stabilized.

XIII. TEMPORARY SEEDING

- Seed in accordance with Soil Conservation Service recommendations with regard to seed type, rate of application, fertilizer, etc.

XIV. SPECIFICATIONS AND DETAILS

1. 6.02 Land Grading

- a. Construct and maintain all erosion and sedimentation control practices and measures in accordance with the approved sedimentation control plan and construction schedule.
- b. Remove good topsoil from areas to be graded and filled, and preserve it for use in finishing the grading of all critical areas.
- c. Scarify areas to be topsoiled to a minimum depth of 2 inches before placing topsoil (Practice 6.04, Topsoiling).
- d. Clear and grub areas to be filled by removing trees, vegetation, roots, or other objectionable material that would affect the planned stability of the fill.
- e. Ensure that fill material is free of brush, rubbish, rocks, logs, stumps, building debris, and other materials inappropriate for constructing stable fills.
- f. Place all fill in layers not to exceed 9 inches in thickness, and compact the layers as required to reduce erosion, slippage, settlement, or other related problems.
- g. Do not incorporate frozen, soft, mucky, or highly compressible materials into fill slopes.
- h. Do not place fill on a frozen foundation, due to possible subsidence and slippage.
- i. Keep diversions and other water conveyance measures free of sediment during all phases of development.
- j. Handle seeps or springs encountered during construction in accordance with approved methods (Practice 6.81, Subsurface Drain).
- k. Permanently stabilize all graded areas immediately after final grading is completed on each area in the grading plan. Apply temporary stabilization measures on all graded areas when work is to be interrupted or delayed for

30 working days or longer.

- i. Show topsoil stockpiles, borrow areas, and spoil areas on the plans, and make sure they are adequately protected from erosion. Include final stabilization of these areas in the plan.

1. 6.06 Temporary Gravel Construction Entrance

- a. Clear the entrance and exit area of all vegetation, roots, and other objectionable material and properly grade it.
- b. Place the gravel to the specific grade and dimensions shown on the plans, and smooth it.
- c. Provide drainage to carry water to a sediment trap or other suitable outlet.
- d. Use geotextile fabrics because they improve stability of the foundation in locations subject to seepage or high water table.

2. 6.14 Mulching

- a. Select a material based on site and practice requirements, availability of material, labor, and equipment. Table 6.14a lists commonly used mulches and some alternatives.
- b. Before mulching, complete the required grading, install sediment control practices, and prepare the seedbed. Apply seed before mulching except in the following cases:
 - Seed is applied as part of a hydroseeder slurry containing wood fiber mulch.
 - A hydroseeder slurry is applied over straw.

c. APPLICATION OF ORGANIC MULCH

Organic mulches are effective where they can be tacked securely to the surface. Material and specifications are given in Table 6.14a.

Spread mulch uniformly by hand, or with a mulch blower. When spreading straw mulch by hand, divide the area to be mulched into sections of approximately 1,000 ft², and place 70-90 lb of straw (1 1/2 to 2 bales) in each section to facilitate uniform distribution. After spreading mulch, no more than 25% of the ground surface should be visible. In hydroseeding operations a green dye, added to the slurry, assures a uniform application.

d. ANCHORING ORGANIC MULCH

Straw mulch must be anchored immediately after spreading. The following methods of anchoring mulch may be used:

Mulch anchoring tool—A tractor-drawn implement designed to punch mulch into the soil, a mulch anchoring tool provides maximum erosion control with straw. A regular farm disk, weighted and set nearly straight, may substitute, but will not do a job comparable to the mulch anchoring tool. The disk should not be sharp enough to cut the straw. These methods are limited to slopes no steeper than 3:1, where equipment can operate safely. Operate machinery on the contour.

Liquid mulch binders—Application of liquid mulch binders and tackifiers should be heaviest at the edges of areas and at crests of ridges and banks, to resist wind. Binder should be applied uniformly to the rest of the area. Binders may be applied after mulch is spread, or may be sprayed into the mulch as it is being blown onto the soil. Applying straw and binder together is the most effective method. Liquid binders include asphalt and an array of commercially available synthetic binders.

Emulsified asphalt is the most commonly used mulch binder. Any type thin enough to be blown from spray equipment is satisfactory. Asphalt is classified according to the time it takes to cure. Rapid setting (RS or CRS designation) is formulated for curing in less than 24 hours, even during periods of high humidity; it is best used in spring and fall. Medium setting (MS or CMS) is formulated for curing within 24 to 48 hours, and slow setting (SS or CSS) is formulated for use during hot, dry weather, requiring 48 hours or more curing time.

Apply asphalt at 0.10 gallons per square yard (10 gal/1,000 ft²). Heavier applications cause straw to “perch” over rills.

In traffic areas, uncured asphalt can be picked up on shoes and cause damage to rugs, clothing etc. Use types RS or CRS to minimize such problems.

Synthetic binders such as Petroset, Terratack, and Aerospray may be used, as recommended by the manufacturer, to anchor mulch. These are expensive, and therefore usually used in small areas or in residential areas where asphalt may be a problem (Use of trade names does not constitute an endorsement).

Mulch nettings—Lightweight plastic, cotton, jute, wire, or paper nets may be stapled over the mulch according to the manufacturer’s recommendations (see “Nets and Mats” below).

Peg and twine—Because it is labor-intensive, this method is feasible only in small areas where other methods

cannot be used. Drive 8-10 inch wooden pegs to within 3 inches of the soil surface, every 4 feet in all directions. Stakes may be driven before or after straw is spread. Secure mulch by stretching twine between pegs in a criss-cross-within-a-square pattern. Turn twine two or more times around each peg. Twine may be tightened over the mulch by driving pegs further into the ground.

Vegetation—Rye (grain) may be used to anchor mulch in fall plantings, and German millet in spring. Broadcast at 15 lb/acre before applying mulch.

e. **CHEMICAL MULCHES**

Chemical mulches may be effective for soil stabilization if used between May 1 and June 15, or Sept. 15 and Oct. 15, provided that they are used on slopes no steeper than 4:1, and that proper seedbed preparation has been accomplished, including surface roughening where required.

Chemical mulches may be used to bind other mulches, or with wood fiber in a hydroseeded slurry at any time. Follow the manufacturer's recommendations for application.

f. **FIBERGLASS ROVING**

Fiberglass roving ("roving") is wound into a cylindrical package so that it can be continuously withdrawn from the center using a compressed air ejector. Roving expands into a mat of glass fibers as it contacts the soil surface. It is often used over a straw mulch, but must still be tacked with asphalt.

Spread roving uniformly over the area at a rate of 0.25 to 0.35 lb/yd². Anchor with asphalt immediately after application, at a rate of 0.25 to 0.35 gal/yd².

As a channel lining, and at other sites of concentrated flow, the roving mat must be further anchored to prevent undermining. It may be secured with stakes placed at intervals no greater than 10 feet along the drainageway, and randomly throughout its width, but not more than 10 feet apart. As an option to staking, the roving can be buried to a depth of 5 inches at the upgrade end and at intervals of 50 feet along the length of the channel.

g. **NETS AND MATS**

Nets alone generally provide little moisture conservation benefits and only limited erosion protection. Therefore, they are usually used in conjunction with an organic mulch such as straw.

Except when wood fiber slurry is used, netting should always be installed over the mulch. Wood fiber may be sprayed on top of an installed net.

Mats, including "excelsior" (wood fiber) blankets, are considered protective mulches and may be used alone, on erodible soils, and during all times of the year. Place the matting in firm contact with the soil, and staple securely.

h. **INSTALLATION OF NETTING AND MATTING**

Products designed to control erosion should be installed in accordance with manufacturer's instructions. Any mat or blanket-type product used as a protective mulch should provide cover of at least 30% of the surface where it is applied. Installation is illustrated in Figure 6.14a.

1. Apply lime, fertilizer, and seed before laying the net or mat.
2. Start laying the net from the top of the channel or slope, and unroll it down the grade. Allow netting to lay loosely on the soil or mulch cover but without wrinkles—do not stretch.
3. To secure the net, bury the upslope end in a slot or trench no less than 6 inches deep, cover with soil, and tamp firmly as shown in Figure 6.14a. Staple the net every 12 inches across the top end and every 3 ft around the edges and bottom. Where 2 strips of net are laid side by side, the adjacent edges should be overlapped 3 inches and stapled together. Each strip of netting should also be stapled down the center, every 3 ft. Do not stretch the net when applying staples.
4. To join two strips, cut a trench to anchor the end of the new net. Overlap the end of the previous roll 18 inches, as shown in Figure 6.14a, and staple every 12 inches just below the anchor slot.

3. 6.51 Hardware Cloth & Gravel Inlet Protection (Temporary)

- a. Uniformly grade a shallow depression approaching the inlet.
- b. Drive 5-foot steel posts 2 feet into the ground surrounding the inlet. Space posts evenly around the perimeter of the inlet, a maximum of 4 feet apart.
- c. Surround the posts with wire mesh hardware cloth. Secure the wire mesh to the steel posts at the top, middle, and bottom. Placing a 2-foot flap of the wire mesh under the gravel for anchoring is recommended.
- d. Place clean gravel (NC DOT #5 or #57 stone) on a 2:1 slope with a height of 16 inches around the wire, and smooth to an even grade.

- e. Once the contributing drainage area has been stabilized, remove accumulated sediment, and establish final grading elevations.
- f. Compact the area properly and stabilize it with groundcover.

4. 6.60 Temporary Sediment Trap

- a. Clear, grub, and strip the area under the embankment of all vegetation and root mat. Remove all surface soil containing high amounts of organic matter, and stockpile or dispose of it properly. Haul all objectionable material to the designated disposal area.
- b. Ensure that fill material for the embankment is free of roots, woody vegetation, organic matter, and other objectionable material. Place the fill in lifts not to exceed 9 inches, and machine compact it. Over fill the embankment 6 inches to allow for settlement.
- c. Construct the outlet section in the embankment. Protect the connection between the riprap and the soil from piping by using filter fabric or a keyway cutoff trench between the riprap structure and soil.
 - 1. Place the filter fabric between the riprap and the soil. Extend the fabric across the spillway foundation and sides to the top of the dam; or
 - 2. Excavate a keyway trench along the center line of the spillway foundation extending up the sides to the height of the dam. The trench should be at least 2 feet deep and 2 feet wide with 1:1 side slopes.
- d. Clear the pond area below the elevation of the crest of the spillway to facilitate sediment cleanout.
- e. All cut and fill slopes should be 2:1 or flatter.
- f. Ensure that the stone (drainage) section of the embankment has a minimum bottom width of 3 feet and maximum side slopes of 1:1 that extend to the bottom of the spillway section.
- g. Construct the minimum finished stone spillway bottom width, as shown on the plans, with 2:1 side slopes extending to the top of the over filled embankment. Keep the thickness of the sides of the spillway outlet structure at a minimum of 21 inches. The weir must be level and constructed to grade to assure design capacity.
- h. Material used in the stone section should be a well-graded mixture of stone with a d50 size of 9 inches (class B erosion control stone is recommended) and a maximum stone size of 14 inches. The stone may be machine placed and the smaller stones worked into the voids of the larger stones. The stone should be hard, angular, and highly weather-resistant.
- i. Discharge inlet water into the basin in a manner to prevent erosion. Use temporary slope drains or diversions with outlet protection to divert sediment-laden water to the upper end of the pool area to improve basin trap efficiency (References: Runoff Control Measures and Outlet Protection).
- j. Ensure that the stone spillway outlet section extends downstream past the toe of the embankment until stable conditions are reached and outlet velocity is acceptable for the receiving stream. Keep the edges of the stone outlet section flush with the surrounding ground, and shape the center to confine the outflow stream (References: Outlet Protection).
- k. Direct emergency bypass to natural, stable areas. Locate bypass outlets so that flow will not damage the embankment.
- l. Stabilize the embankment and all disturbed areas above the sediment pool and downstream from the trap immediately after construction (References: Surface Stabilization).
- m. Show the distance from the top of the spillway to the sediment cleanout level (1/2 the design depth) on the plans and mark it in the field.
- n. Install porous baffles as specified in Practice 6.65, Porous Baffles.

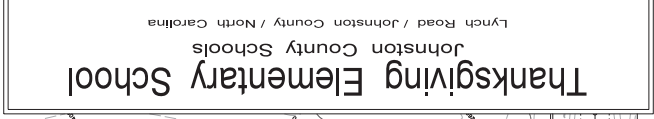
5. 6.62 Temporary Sediment Fence

- a. MATERIALS
 - 1. Use a synthetic filter fabric of at least 95% by weight of polyolefins or polyester, which is certified by the manufacturer or supplier as conforming to the requirements in ASTM D 6461, which is shown in part in Table 6.62b.
Synthetic filter fabric should contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 to 120° F.
 - 2. Ensure that posts for sediment fences are 1.33 lb/linear ft steel with a minimum length of 5 feet. Make sure that steel posts have projections to facilitate fastening the fabric.
 - 3. For reinforcement of standard strength filter fabric, use wire fence with a minimum 14 gauge and a maximum mesh spacing of 6 inches.

APPENDIX CALCULATIONS

**APPENDIX
DRAINAGE AREAS**

Hite Associates
ARCHITECTURE / PLANNING / TECHNOLOGY
2600 Meridian Drive / Greenville, NC 27834 / tel (252) 757-0333



No.	Base	Revision

hite associates
ARCHITECTURE / PLANNING / TECHNOLOGY

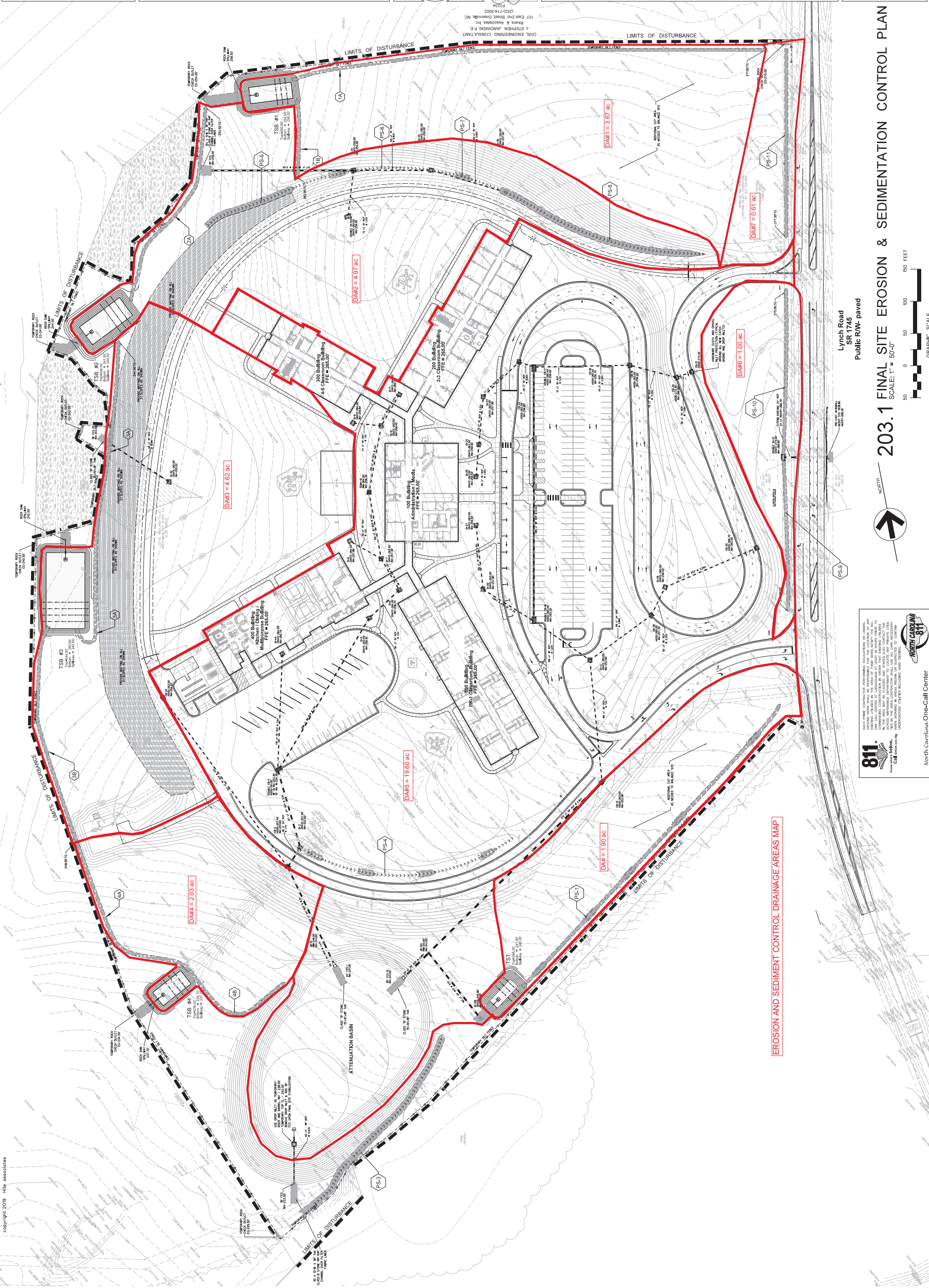
2600 Meridian Drive / Greenville NC 27834 / tel(252) 757-0333



Thanksiving Elementary School
Johnston County Schools

Lynch Road / Johnston County / North Carolina

Project No. 21820
Date: December 2019
Drawing No. **C**
203



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North Carolina
811
One-Call Center

203.1 FINAL SITE EROSION & SEDIMENTATION CONTROL PLAN
SCALE: 1" = 50'-0"

Lynch Road
SR 1745
Public R/W - paved

203.1 FINAL SITE EROSION & SEDIMENTATION CONTROL PLAN
SCALE: 1" = 50'-0"

GRAPHIC SCALE
0 50 100 150 FEET

GRAPHIC SCALE
0 50 100 150 FEET

No.	DATE	REVISION

2600 Meridian Drive / Greenville NC 27834 / tel(252) 757-0333

hite associates

ARCHITECTURE / PLANNING / TECHNOLOGY



Thanksyving Elementary School

Johnston County Schools

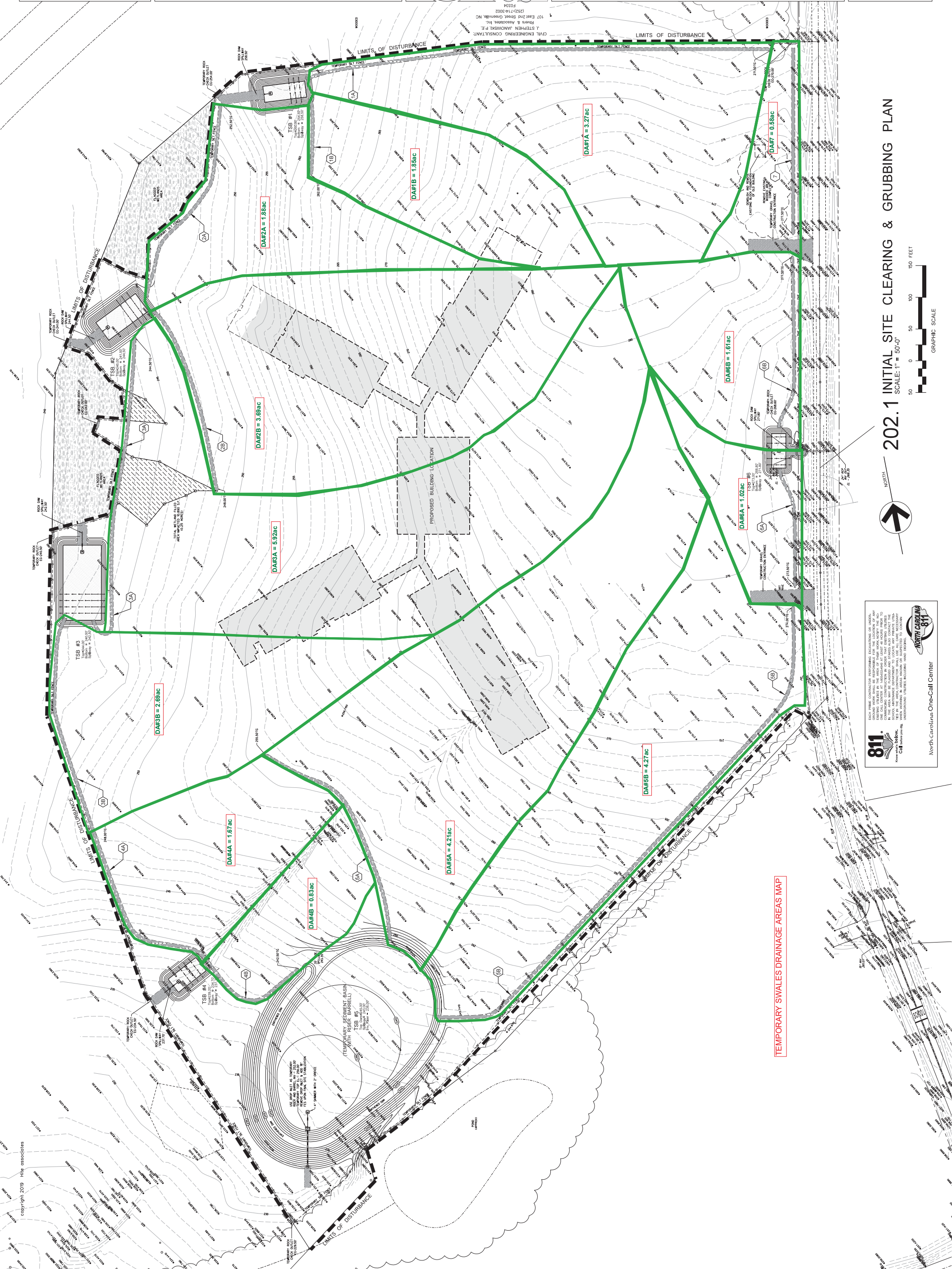
Lynch Road / Johnston County / North Carolina

Project No. 21820

Drawn By: December 2019

Sheet No. C

202



811. NORTH CAROLINA 811

Call before you dig. Know what's below. Underground utilities located and marked. Call before you dig.

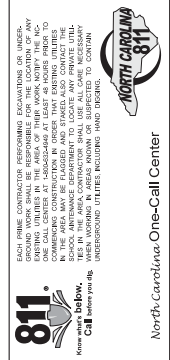
North Carolina One-Call Center

202.1 INITIAL SITE CLEARING & GRUBBING PLAN

SCALE: 1" = 50'-0"

GRAPHIC SCALE

0 50 100 150 FEET



A horizontal graphic scale bar with vertical tick marks at 50, 100, and 150 feet. The text "GRAPHIC SCALE" is centered below the bar.

**APPENDIX
SKIMMER BASINS
CALCULATIONS**

IDF Curve - Rainfall Intensity

Thanksgiving Elementary School Johnston County, NC

Input Data from NOAA

	Average recurrence interval (years)
T (min)	10
10	0.99
15	1.25
30	1.82

Calculation of Design Rainfall Intensity, i , using the equation: $i = g/(h + T)$

10 yr

Data from IDF graph

T, min	i, in/hr	1/i, hr/in
10	5.94	0.17
15	5.00	0.20
30	3.64	0.27

Equation Constants (g & h)

Slope = $1/g$	0.0052
Intercept = h/g	0.1183
$g = 1/\text{slope}$	190.8
$h = g \cdot \text{intercept}$	22.6

HYDROLOGIC ANALYSIS
Thanksgiving Elementary School
Johnston County, NC
Skimmer Basin 1
Pre and Post Development Site Conditions

Site Information				
Total Watershed Area (Ac)				
Predevelopment (Phase I)				
Land Type	Rational C	CN	Acres	
Transporation/Sidewalk	0.95	98	0.00	
Building	0.95	98	0.00	
Denuded Land	0.35	61	5.22	
Wooded	0.20	50	0.00	
Total Area (Ac)			5.22	
Composite	0.35	61.00		
	Overland	Channelized		
Hydraulic Length (ft)	340	773		
Vertical Relief (ft)	10.00	12.50		
Time of Concentration				
Time (min)	Overland	Channelized	Total	Q10 cfs
	5.40	6.40	11.81	10.14
Travel Factor	2	1		

Post Development (Phase 2)				
Land Type	Rational C	CN	Acres	
Transporation/Sidewalk	0.95	98	0.00	
Building	0.95	98	0.00	
Denuded Land	0.35	61	3.67	
Wooded	0.20	50	0.00	
Total Area (Ac)			3.67	
Composite	0.35	61.00		
	Overland	Channelized		
Hydraulic Length (ft)	296	773		
Vertical Relief (ft)	5.50	12.50		
Time of Concentration				
Time (min)	Overland	Channelized	Total	Q10 cfs
	5.80	6.40	12.20	7.05
Travel Factor	2	1		

Post Development By Passed Flow (If Needed)				
Land Type	Rational C		Acres	
Transporation	0.95		0.00	
Building	0.95		0.00	
Managed Pervious Flat Lawn<2% dense	0.35		0.00	
Wooded	0.20		0.00	
Total Area (Ac)			0.00	
Composite	0.00			

Skimmer Basin No. 1	
Thanksgiving Elementary School	
Johnston County, NC	
Okay	
5.22	Disturbed Area (Acres)
10.14	Peak Flow from 10-year Storm (cfs)
9396	Required Volume ft ³
3296	Required Surface Area ft ²
40.6	Suggested Width ft
81.2	Suggested Length ft
41	Trial Top Width at Spillway Invert ft
82	Trial Top Length at Spillway Invert ft
2	Trial Side Slope Ratio Z:1
4	Trial Depth ft
	(2 to 3.5 feet above grade)
25	Bottom Width ft
66	Bottom Length ft
1650	Bottom Area ft ²
9853	Actual Volume ft ³
3362	Actual Surface Area ft ²
	Okay
	Okay
10	Trial Weir Length ft
0.5	Trial Depth of Flow ft
10.6	Spillway Capacity cfs
0.49	Actual Depth ft
2.09	Velocity cfs
	Okay
5	Skimmer Size (inches)
0.333	Head on Skimmer (feet)
1.5	Orifice Size (1/4 inch increments)
3.29	Dewatering Time (days)
	Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

HYDROLOGIC ANALYSIS
Thanksgiving Elementary School
Johnston County, NC
Skimmer Basin 2
Pre and Post Development Site Conditions

Site Information				
Total Watershed Area (Ac)				
Predevelopment				
Land Type	Rational C	CN	Acres	
Transporation/Sidewalk	0.95	98	0.00	
Building	0.95	98	0.00	
Denuded Land	0.35	61	6.37	
Wooded	0.20	50	0.00	
Total Area (Ac)			5.92	
Composite			0.35	61.00
	Overland	Channelized		
Hydraulic Length (ft)	765	345		
Vertical Relief (ft)	34.00	6.50		
If Tc<10, use 10 min				
Time of Concentration				
	Overland	Channelized	Total	Q10 cfs
Time (min)	8.61	3.24	11.85	11.49
Travel Factor	2	1		
Post Development				
Land Type	Rational C	CN	Acres	
Transporation/Sidewalk	0.95	98	0.00	
Building	0.95	98	0.42	
Denuded Land	0.35	61	4.55	
Wooded	0.20	50	0.00	
Total Area (Ac)			4.97	
Composite			0.40	64.13
	Overland	Channelized		
Hydraulic Length (ft)	125	1,110		
Vertical Relief (ft)	17.50	31.00		
If Tc<10, use 10 min				
Time of Concentration				
	Overland	Channelized	Total	Q10 cfs
Time (min)	1.37	6.85	10.00	11.67
Travel Factor	2	1		
Post Development By Passed Flow (If Needed)				
Land Type	Rational C		Acres	
Transporation	0.95		0.00	
Building	0.95		0.00	
Managed Pervious Flat Lawn<2% dense	0.35		0.00	
Wooded	0.20		0.00	
Total Area (Ac)			0.00	
Composite			0.00	

Skimmer Basin No. 2	
Thanksgiving Elementary School	
Johnston County, NC	
Okay	
5.92	Disturbed Area (Acres)
11.49	Peak Flow from 10-year Storm (cfs)
10656	Required Volume ft ³
3733	Required Surface Area ft ²
43.2	Suggested Width ft
86.4	Suggested Length ft
50	Trial Top Width at Spillway Invert ft
93	Trial Top Length at Spillway Invert ft
2	Trial Side Slope Ratio Z:1
3	Trial Depth ft
	(2 to 3.5 feet above grade)
38	Bottom Width ft
81	Bottom Length ft
3078	Bottom Area ft ²
11520	Actual Volume ft ³
4650	Actual Surface Area ft ²
	Okay
12.5	Trial Weir Length ft
0.5	Trial Depth of Flow ft
13.3	Spillway Capacity cfs
0.45	Actual Depth ft
2.02	Velocity cfs
	Okay
5	Skimmer Size (inches)
0.333	Head on Skimmer (feet)
1.75	Orifice Size (1/4 inch increments)
2.82	Dewatering Time (days)
	Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

HYDROLOGIC ANALYSIS
Thanksgiving Elementary School
Johnston County, NC
Skimmer Basin 3
Pre and Post Development Site Conditions

Site Information				
Total Watershed Area (Ac)				
Predevelopment				
Land Type	Rational C	CN	Acres	
Transporation/Sidewalk	0.95	98	0.00	
Building	0.95	98	0.00	
Disturbed Land	0.35	61	8.32	
Wooded	0.20	50	0.00	
Total Area (Ac)			8.65	
Composite	0.35	61		
	Overland	Channelized		
Hydraulic Length (ft)	1,103	320		
Vertical Relief (ft)	39.30	5.30		
If Tc<10, use 10 min				
Time of Concentration				
Time (min)	Overland	Channelized	Total	Q10 sfs
	12.42	3.22	15.64	15.12
Travel Factor	2	1		

Post Development				
Land Type	Rational C	CN	Acres	
Transporation/Sidewalk	0.95	98	0.00	
Building	0.95	98	0.00	
Denuded Land	0.35	61	4.62	
Wooded	0.20	50	0.00	
Total Area (Ac)			4.62	
Composite	0.35	61.00		
	Overland	Channelized		
Hydraulic Length (ft)	281	320		
Vertical Relief (ft)	19.00	5.30		
If Tc<10, use 10 min				
Time of Concentration				
Time (min)	Overland	Channelized	Total	Q10 sfs
	3.39	3.22	10.00	9.47
Travel Factor	2	1		
Post Development By Passed Flow (If Needed)				
Land Type	Rational C		Acres	
Transporation	0.95		0.00	
Building	0.95		0.00	
Managed Pervious Flat Lawn<2% dense	0.35		0.00	
Wooded	0.20		0.00	
Total Area (Ac)			0.00	
Composite	0.00			

Skimmer Basin No. 3		
Thanksgiving Elementary School		
Johnston County, NC		
Okay		
8.65	Disturbed Area (Acres)	
15.12	Peak Flow from 10-year Storm (cfs)	
15570	Required Volume ft ³	
4914	Required Surface Area ft ²	
49.6	Suggested Width ft	
99.1	Suggested Length ft	
68	Trial Top Width at Spillway Invert ft	
126	Trial Top Length at Spillway Invert ft	
2	Trial Side Slope Ratio Z:1	
2	Trial Depth ft	(2 to 3.5 feet above grade)
60	Bottom Width ft	
118	Bottom Length ft	
7080	Bottom Area ft ²	
15627	Actual Volume ft ³	Okay
8568	Actual Surface Area ft ²	Okay
15	Trial Weir Length ft	
0.5	Trial Depth of Flow ft	
15.9	Spillway Capacity cfs	Okay
0.48	Actual Depth ft	
2.09	Velocity cfs	
5	Skimmer Size (inches)	
0.333	Head on Skimmer (feet)	
2	Orifice Size (1/4 inch increments)	
2.93	Dewatering Time (days)	
	Suggest about 3 days	

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

HYDROLOGIC ANALYSIS
Thanksgiving Elementary School
Johnston County, NC
Skimmer Basin 4
Pre and Post Development Site Conditions

Site Information				
Total Watershed Area (Ac)	0.00			
Predevelopment				
Land Type	Rational C	CN	Acres	
Transporation/Sidewalk	0.95	98	0.00	
Building	0.95	98	0.00	
Disturbed Land	0.35	61	2.60	
Wooded	0.20	50	0.00	
Total Area (Ac)			2.60	
Composite	0.35	61		
	Overland	Channelized		
Hydraulic Length (ft)	337	287		
Vertical Relief (ft)	20.50	13.00		
If Tc<10, use 10 min				
Time of Concentration				
Time (min)	Overland	Channelized	Total	Q10 cfs
	4.06	2.01	10.00	5.33
Travel Factor	2	1		

Post Development				
Land Type	Rational C	CN	Acres	
Transporation/Sidewalk	0.95	98	0.00	
Building	0.95	98	0.00	
Cultivated land	0.35	61	2.03	
Wooded	0.20	50	0.00	
Total Area (Ac)			2.03	
Composite	0.35	61.00		
	Overland	Channelized		
Hydraulic Length (ft)	319	288		
Vertical Relief (ft)	26.50	13.00		
If Tc<10, use 10 min				
Time of Concentration				
Time (min)	Overland	Channelized	Total	Q10 cfs
	3.44	2.01	10.00	4.16
Travel Factor	2	1		
Post Development By Passed Flow (If Needed)				
Land Type	Rational C		Acres	
Transporation	0.95		0.00	
Building	0.95		0.00	
Managed Pervious Flat Lawn<2% dense	0.35		0.00	
Wooded	0.20		0.00	
Total Area (Ac)			0.00	
Composite	0.00			

Skimmer Basin No. 4	
Thanksgiving Elementary School	
Johnston County, NC	
Okay	
2.60	Disturbed Area (Acres)
5.33	Peak Flow from 10-year Storm (cfs)
4680	Required Volume ft ³
1733	Required Surface Area ft ²
29.4	Suggested Width ft
58.9	Suggested Length ft
34	Trial Top Width at Spillway Invert ft
63	Trial Top Length at Spillway Invert ft
2	Trial Side Slope Ratio Z:1
3	Trial Depth ft
	(2 to 3.5 feet above grade)
22	Bottom Width ft
51	Bottom Length ft
1122	Bottom Area ft ²
4824	Actual Volume ft ³
2142	Actual Surface Area ft ²
	Okay
	Okay
5.5	Trial Weir Length ft
0.5	Trial Depth of Flow ft
5.8	Spillway Capacity cfs
0.47	Actual Depth ft
2.06	Velocity cfs
	Okay
3	Skimmer Size (inches)
0.25	Head on Skimmer (feet)
1.25	Orifice Size (1/4 inch increments)
2.67	Dewatering Time (days)
	Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

HYDROLOGIC ANALYSIS
Thanksgiving Elementary School
Johnston County, NC
Skimmer Basin 5
Pre and Post Development Site Conditions

Site Information				
Total Watershed Area (Ac)	0.00			
Predevelopment				
Land Type	Rational C	CN	Acres	
Transporation/Sidewalk	0.95	98	0.28	
Building	0.95	98	0.00	
Denuded Land	0.35	61	2.47	
Wooded	0.15	70	0.00	
Total Area (Ac)			2.75	
Composite	0.41	64.77		
	Overland	Channelized		
Hydraulic Length (ft)	380	209		
Vertical Relief (ft)	10.00	3.00		
If Tc<10, use 10 min				
Time of Concentration				
Time (min)	Overland	Channelized	Total	Q10 cfs
	6.14	2.45	10.00	6.62
Travel Factor	2	1		

Post Development				
Land Type	Rational C	CN	Acres	
Transporation/Sidewalk	0.95	98	0.28	
Building	0.95	98	0.00	
Denuded Land	0.35	61	0.72	
Wooded	0.15	70	0.00	
Total Area (Ac)			1.00	
Composite	0.52	71.36		
	Overland	Channelized		
Hydraulic Length (ft)	210	213		
Vertical Relief (ft)	5.00	3.00		
If Tc<10, use 10 min				
Time of Concentration				
Time (min)	Overland	Channelized	Total	Q10 cfs
	4.03	2.50	10.00	3.03
Travel Factor	2	1		
Post Development By Passed Flow (If Needed)				
Land Type	Rational C		Acres	
Transporation	0.95		0.00	
Building	0.95		0.00	
Managed Pervious Flat Lawn<2% dense	0.35		0.00	
Wooded	0.15		0.00	
Total Area (Ac)			0.00	
Composite	0.00			

Skimmer Basin No. 5		
Thanksgiving Elementary School		
Johnston County, NC		
Okay		
2.75	Disturbed Area (Acres)	
6.62	Peak Flow from 10-year Storm (cfs)	
4950	Required Volume ft ³	
2153	Required Surface Area ft ²	
32.8	Suggested Width ft	
65.6	Suggested Length ft	
34	Trial Top Width at Spillway Invert ft	
66	Trial Top Length at Spillway Invert ft	
2	Trial Side Slope Ratio Z:1	
3	Trial Depth ft	(2 to 3.5 feet above grade)
22	Bottom Width ft	
54	Bottom Length ft	
1188	Bottom Area ft ²	
5076	Actual Volume ft ³	Okay
2244	Actual Surface Area ft ²	Okay
6.5	Trial Weir Length ft	
0.5	Trial Depth of Flow ft	
6.9	Spillway Capacity cfs	Okay
0.49	Actual Depth ft	
2.09	Velocity cfs	
5	Skimmer Size (inches)	
0.333	Head on Skimmer (feet)	
1.25	Orifice Size (1/4 inch increments)	
2.44	Dewatering Time (days)	
	Suggest about 3 days	

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

HYDROLOGIC ANALYSIS
Thanksgiving Elementary School
Johnston County, NC
Temporary Sediment Trap
Pre and Post Development Site Conditions

Site Information				
Total Watershed Area (Ac)	0.00			
Predevelopment				
Land Type	Rational C	CN	Acres	
Transporation/Sidewalk	0.95	98	0.00	
Building	0.95	98	0.00	
Denuded Land	0.35	61	0.00	
Wooded	0.15	70	0.00	
Total Area (Ac)			0.00	
Composite	0.00	0		
	Overland	Channelized		
Hydraulic Length (ft)	0	0		
Vertical Relief (ft)	0.00	0.00		
If Tc<10, use 10 min				
Time of Concentration				
	Overland	Channelized	Total	Q10 cfs
Time (min)	0.00	0.00	0.00	0
Travel Factor	2	1		
Post Development				
Land Type	Rational C	CN	Acres	
Transporation/Sidewalk	0.95	98	0.00	
Building	0.95	98	0.00	
Denuded land	0.35	61	1.90	
Wooded	0.15	70	0.00	
Total Area (Ac)			1.90	
Composite	0.35	61.00		
	Overland	Channelized		
Hydraulic Length (ft)	588	173		
Vertical Relief (ft)	23.00	6.00		
If Tc<10, use 10 min				
Time of Concentration				
	Overland	Channelized	Total	Q10 cfs
Time (min)	7.37	1.51	10.00	3.90
Travel Factor	2	1		
Post Development By Passed Flow (If Needed)				
Land Type	Rational C		Acres	
Transporation	0.95		0.00	
Building	0.95		0.00	
Managed Pervious Flat Lawn<2% dense	0.35		0.00	
Wooded	0.15		0.00	
Total Area (Ac)			0.00	
Composite	0.00			

Temporary Sediment Trap	
Thanksgiving Elementary School	
Johnston County, NC	
Okay	
1.9	Disturbed Area (Acres)
3.90	Peak Flow from 10-year Storm (cfs)
6840	Required Volume ft ³
1697	Required Surface Area ft ²
29.1	Suggested Width ft
58.3	Suggested Length ft
36	Trial Top Width at Spillway Invert ft
65	Trial Top Length at Spillway Invert ft
2	Trial Side Slope Ratio Z:1
4.5	Trial Depth ft
18	Bottom Width ft
47	Bottom Length ft
846	Bottom Area ft ²
6926	Actual Volume ft ³
2340	Actual Surface Area ft ²
4	Trial Weir Length ft
0.5	Trial Depth of Flow ft
4.2	Spillway Capacity cfs
0.47	Actual Depth ft
2.06	Velocity cfs

(1.5 feet below grade + 2 to 3.5 feet above grade)

Okay

Okay

(0.5' min.)

Okay

STORM WATER DETENTION ROUTING
Thanksgiving Elementary School
Johnston County, NC
Temporary Sediment Basin
Pre and Post Development Site Conditions

Site Information				
Total Watershed Area (Ac)	9.76			
Predevelopment				
Land Type	Rational C	CN	Acres	
Transporation/Sidewalk	0.95	98	0.00	
Building	0.95	98	0.00	
Denuded Land	0.35	74	9.76	
Wooded	0.15	70	0.00	
Total Area (Ac)			9.76	
Composite	0.35	74		
	Overland	Channelized		
Hydraulic Length (ft)	987	840		
Vertical Relief (ft)	35.00	30.00		
If Tc<10, use 10 min				
Time of Concentration				
Time (min)	Overland	Channelized	Total	Q10 cfs
	11.42	5.03	16.45	16.70
Travel Factor	2	1		

Post Development				
Land Type	Rational C	CN	Acres	
Transporation/Sidewalk	0.95	98	4.95	
Building	0.95	98	1.95	
Denuded Land	0.35	74	12.70	
Wooded	0.15	70	0.00	
Total Area (Ac)			19.60	
Composite	0.56	82.45		
	Overland	Channelized		
Hydraulic Length (ft)	269	1,379		
Vertical Relief (ft)	2.50	32.00		
If Tc<10, use 10 min				
Time of Concentration				
Time (min)	Overland	Channelized	Total	Q10 cfs
	7.02	8.70	15.71	54.83
Travel Factor	2	1		
Post Development By Passed Flow (If Needed)				
Land Type	Rational C		Acres	
Transporation	0.95		0.00	
Building	0.95		0.00	
Managed Pervious Lawn	0.35		0.00	
Wooded	0.15		0.00	
Total Area (Ac)			0.00	
Composite	0.00			

Temporary Sediment Basin
Thanksgiving Elementary School
Johnston County, NC

Okay

19.60	Disturbed Area (Acres)
54.83	Peak Flow from 10-year Storm (cfs)
35280	Required Volume ft ³
23882	Required Surface Area ft ²
109.3	Suggested Width ft
218.6	Suggested Length ft
110	Trial Top Width at Spillway Invert ft
220	Trial Top Length at Spillway Invert ft
3	Trial Side Slope Ratio Z:1
5	Trial Depth ft
80	Bottom Width ft
190	Bottom Length ft
15200	Bottom Area ft ²
97750	Actual Volume ft ³
24200	Actual Surface Area ft ²

(2 to 13 feet above grade)

Okay

Okay

Use Spillway Capacity Sheet to Size Primary and Emergency Spillways

8	Skimmer Size (inches)
0.5	Head on Skimmer (feet)
4.25	Orifice Size (1/4 inch increments)
3.31	Dewatering Time (days)
	Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

**APPENDIX
SWALE
CALCULATIONS**

IDF Curve - Rainfall Intensity

Thanksgiving Elementary School Johnston County, NC

Input Data from NOAA		
	Average recurrence interval (years)	
T (min)	2	10
10	0.772	1.00
15	0.97	1.25
30	1.34	1.82

Calculation of Design Rainfall Intensity, i , using the equation: $i = g/(h + T)$

2 yr

Data from IDF graph		
T, min	i, in/hr	1/i, hr/in
10	4.63	0.22
15	3.88	0.26
30	2.68	0.37

Equation Constants (g & h)	
Slope = $1/g$	0.0078
Intercept = h/g	0.1388
$g = 1/\text{slope}$	127.8
$h = g \cdot \text{intercept}$	17.7

Calculation of Design Rainfall Intensity, i , using the equation: $i = g/(h + T)$

10 yr

Data from IDF graph		
T, min	i, in/hr	1/i, hr/in
10	6.00	0.17
15	5.00	0.20
30	3.64	0.27

Equation Constants (g & h)	
Slope = $1/g$	0.0053
Intercept = h/g	0.1165
$g = 1/\text{slope}$	188.5
$h = g \cdot \text{intercept}$	22.0

SWALE CALCULATIONS for Temporary Swale

Thanksgiving Elementary School

Johnston County, NC

Swale 1A in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)		3.27			
Land Type		Rational C	CN	Acres	
Area Impervious		0.95	98	0.00	
denuded with temporary seeding		0.35	60	3.27	
Total watershed area				3.27	
Composite		0.35			
		Overland	Channelized		
Hydraulic Length (ft)		300	724		
Vertical Relief (ft)		8.50	13.00		
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$		Overland	Channelized	Total	If Tc<10, use 10 min
	Time (min)	4.98	5.85	10.82	
	Travel Factor	2	1		
Rainfall Intensity =		I = g/(h+T)	4.5	inches per hr	
Peak Discharge =		Q=CIA	5.1	cfs	
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	1.80%	4.44 fps	0.76 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.851	straw netting =		Td=	1.45 lb/sf ok

SWALE CALCULATIONS for Temporary Swale
Thanksgiving Elementary School
Johnston County, NC

Swale 1A in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	1.85				
Land Type	Rational C	CN	Acres		
Area Impervious	0.95	98	0.00		
denuded with temporary seeding	0.35	60	1.85		
Total watershed area			1.85		
Composite	0.35				
	Overland	Channelized			
Hydraulic Length (ft)	465	200			
Vertical Relief (ft)	21.50	0.50			
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$ Time (min)	Overland	Channelized	Total	If Tc<10, use 10 min	
Travel Factor	5.78	4.64	10.42		
	2	1			
Rainfall Intensity =	I = g/(h+T)	4.5	inches per hr		
Peak Discharge =	Q=CIA	2.9	cfs		
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	0.25%	1.86 fps	0.89 ft
Tractive Force					
Td= YDS (lb/sf)	0.139	use temporary liner jute netting = Td= 0.45 lb/sf ok			

SWALE CALCULATIONS for Temporary Swale
Thanksgiving Elementary School
Johnston County, NC

Swale 2A in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	1.88				
Land Type	Rational C	CN	Acres		
Area Impervious	0.95	98	0.000		
Denuded with temporary seeding	0.35	60	1.880		
Total watershed area			1.880		
Composite	0.35				
	Overland	Channelized			
Hydraulic Length (ft)	151	345			
Vertical Relief (ft)	9.00	6.50			
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$ Time (min) Travel Factor	Overland	Channelized	Total	If Tc<10, use 10 min	
	2.20	3.24	10.00		
	2	1			
Rainfall Intensity =	I = g/(h+T)	4.6	inches per hr		
Peak Discharge =	Q=CIA	3.0	cfs		
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	1.88%	3.98 fps	0.62 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.725	straw netting =		Td=	1.45 lb/sf ok

SWALE CALCULATIONS for Temporary Swale
Thanksgiving Elementary School
Johnston County, NC

Swale 2B in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	3.69				
Land Type	Rational C	CN	Acres		
Area Impervious	0.95	98	0.000		
Denuded with temporary seeding	0.35	60	3.690		
Total watershed area			3.690		
Composite	0.35				
	Overland	Channelized			
Hydraulic Length (ft)	765	275			
Vertical Relief (ft)	34.00	2.50			
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$ Time (min) Travel Factor	Overland	Channelized	Total	If Tc<10, use 10 min	
	8.61	3.61	12.21		
	2	1			
Rainfall Intensity =	I = g/(h+T)	4.3	inches per hr		
Peak Discharge =	Q=CIA	5.5	cfs		
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	0.91%	3.50 fps	0.89 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.504	steaw netting =		Td=	1.45 lb/sf ok

SWALE CALCULATIONS for Temporary Swale
Thanksgiving Elementary School
Johnston County, NC

Swale 3A in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	5.92				
Land Type	Rational C	CN	Acres		
Area Impervious	0.95	98	0.000		
denuded with temporary seeding	0.35	60	5.920		
Total watershed area			5.920		
Composite	0.35				
	Overland	Channelized			
Hydraulic Length (ft)	905	472			
Vertical Relief (ft)	36.00	2.30			
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$ Time (min) Travel Factor	Overland	Channelized	Total	If Tc<10, use 10 min	
	10.22	6.95	17.17		
	2	1			
Rainfall Intensity =	$I = g/(h+T)$	3.7	inches per hr		
Peak Discharge =	$Q=CIA$	7.6	cfs		
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	0.49%	2.99 fps	1.13 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.343	jute netting =		Td=	0.45 lb/sf ok

SWALE CALCULATIONS for Temporary Swale
Thanksgiving Elementary School
Johnston County, NC

Swale 3B in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	2.69				
Land Type	Rational C	CN	Acres		
Area Impervious	0.95	98	0.000		
denuded with temporary seeding	0.35	60	2.690		
Total watershed area			2.690		
Composite	0.35				
	Overland	Channelized			
Hydraulic Length (ft)	691	300			
Vertical Relief (ft)	21.00	5.30			
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$ Time (min) Travel Factor	Overland	Channelized	Total	If Tc<10, use 10 min	
	9.21	2.99	12.20		
	2	1			
Rainfall Intensity =	I = g/(h+T)	4.3	inches per hr		
Peak Discharge =	Q=CIA	4.0	cfs		
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	1.77%	4.15 fps	0.70 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.767	straw netting =		Td=	1.45 lb/sf ok

SWALE CALCULATIONS for Temporary Swale
Thanksgiving Elementary School
Johnston County, NC

Swale 4A in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	1.67				
Land Type	Rational C	CN	Acres		
Area Impervious	0.95	98	0.00		
denuded with temporary seeding	0.5	60	1.67		
Total watershed area			1.67		
Composite	0.50				
	Overland	Channelized			
Hydraulic Length (ft)	286	306			
Vertical Relief (ft)	7.00	9.80			
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$ Time (min) Travel Factor	Overland	Channelized	Total	If Tc<10, use 10 min	
	5.08	2.41	10.00		
	2	1			
Rainfall Intensity =	I = g/(h+T)	4.6	inches per hr		
Peak Discharge =	Q=CIA	3.8	cfs		
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	3.20%	5.16 fps	0.61 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	1.220	straw netting =		Td=	1.45 lb/sf ok

SWALE CALCULATIONS for Temporary Swale
Thanksgiving Elementary School
Johnston County, NC

Swale 4B in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	0.83				
Land Type	Rational C	CN	Acres		
Area Impervious	0.95	98	0.00		
denuded with temporary seeding	0.35	60	0.83		
Total watershed area			0.83		
Composite	0.35				
	Overland	Channelized			
Hydraulic Length (ft)	238	94			
Vertical Relief (ft)	11.50	0.30			
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$ Time (min) Travel Factor	Overland	Channelized	Total	If Tc<10, use 10 min	
	3.39	2.36	10.00		
	2	1			
Rainfall Intensity =	I = g/(h+T)	4.6	inches per hr		
Peak Discharge =	Q=CIA	1.3	cfs		
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	0.32%	1.69 fps	0.63 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.125	jute netting =		Td=	0.45 lb/sf ok

SWALE CALCULATIONS for Temporary Swale
Thanksgiving Elementary School
Johnston County, NC

Swale 5A in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	4.21				
Land Type	Rational C	CN	Acres		
Area Impervious	0.95	98	0.00		
denuded with temporary seeding	0.35	73	4.21		
Total watershed area			4.21		
Composite	0.35				
	Overland	Channelized			
Hydraulic Length (ft)	917	379			
Vertical Relief (ft)	24.00	11.50			
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$ Time (min) Travel Factor	Overland	Channelized	Total	If Tc<10, use 10 min	
	12.13	2.90	15.04		
	2	1			
Rainfall Intensity =	I = g/(h+T)	3.9	inches per hr		
Peak Discharge =	Q=CIA	5.7	cfs		
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	3.03%	5.58 fps	0.72 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	1.359	straw netting =		Td=	1.45 lb/sf ok

SWALE CALCULATIONS for Temporary Swale
Thanksgiving Elementary School
Johnston County, NC

Swale 5A in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	4.27				
Land Type	Rational C	CN	Acres		
Area Impervious	0.95	98	0.00		
denuded with temporary seeding	0.35	60	4.27		
Total watershed area			4.27		
Composite	0.35				
	Overland	Channelized			
Hydraulic Length (ft)	276	864			
Vertical Relief (ft)	3.00	29.00			
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$ Time (min) Travel Factor	Overland	Channelized	Total	If Tc<10, use 10 min	
	6.75	5.27	12.02		
	2	1			
Rainfall Intensity =	I = g/(h+T)	4.3	inches per hr		
Peak Discharge =	Q=CIA	6.4	cfs		
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	3.36%	5.93 fps	0.74 ft
Tractive Force		synthetic			
Td= YDS (lb/sf)	1.541	mat Td= 2 lb/sf ok			

SWALE CALCULATIONS for Temporary Swale
Thanksgiving Elementary School
Johnston County, NC

Swale 6A in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	1.02				
Land Type	Rational C	CN	Acres		
Area Impervious	0.95	98	0.000		
denuded with temporary seeding	0.35	60	1.020		
Total watershed area			1.020		
Composite	0.35				
	Overland	Channelized			
Hydraulic Length (ft)	191	182			
Vertical Relief (ft)	3.00	1.70			
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$ Time (min) Travel Factor	Overland	Channelized	Total	If Tc<10, use 10 min	
	4.41	2.60	10.00		
	2	1			
Rainfall Intensity =	I = g/(h+T)	4.6	inches per hr		
Peak Discharge =	Q=CIA	1.6	cfs		
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	0.93%	2.66 fps	0.56 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.324	Jute netting	Td=	0.45 lb/sf	ok

SWALE CALCULATIONS for Temporary Swale
Thanksgiving Elementary School
Johnston County, NC

Swale 6B in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	1.61				
Land Type	Rational C	CN	Acres		
Area Impervious	0.95	98	0.000		
denuded with temporary seeding	0.35	60	1.610		
Total watershed area			1.610		
Composite	0.35				
	Overland	Channelized			
Hydraulic Length (ft)	289	251			
Vertical Relief (ft)	7.00	2.70			
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$ Time (min) Travel Factor	Overland	Channelized	Total	If Tc<10, use 10 min	
	5.14	3.15	10.00		
	2	1			
Rainfall Intensity =	I = g/(h+T)	4.6	inches per hr		
Peak Discharge =	Q=CIA	2.6	cfs		
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	1.08%	3.08 fps	0.65 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.436	Jute netting	Td=	0.45 lb/sf	ok

SWALE CALCULATIONS for Temporary Swale
Thanksgiving Elementary School
Johnston County, NC

Swale 7 in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	0.58				
Land Type	Rational C	CN	Acres		
Area Impervious	0.95	98	0.00		
denuded with temporary seeding	0.35	60	0.58		
Total watershed area			0.58		
Composite	0.35				
	Overland	Channelized			
Hydraulic Length (ft)	149	311			
Vertical Relief (ft)	0.50	5.50			
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$ Time (min) Travel Factor	Overland	Channelized	Total	If Tc<10, use 10 min	
	6.60	3.07	10.00		
	2	1			
Rainfall Intensity =	I = g/(h+T)	4.6	inches per hr		
Peak Discharge =	Q=CIA	0.9	cfs		
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	1.77%	2.96 fps	0.40 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.439	Jute netting	Td=	0.45 lb/sf	ok

SWALE CALCULATIONS for Permanent Swale

Thanksgiving Elementary School

Johnston County, NC

Permanent Swale 1

Outlet Based on 2 year storm

Total watershed area (Ac)		1.90															
Land Type		Rational C	CN	Acres													
Area Impervious		0.95	98	0.000													
denuded with temporary seeding		0.35	60	1.900													
Total watershed area				1.900													
Composite		0.35															
	Overland	Channelized															
Hydraulic Length (ft)	87	581															
Vertical Relief (ft)	0.40	23.00															
Time of Concentration																	
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$	Overland	Channelized	Total	If Tc<10, use 10 min													
	3.87	3.64	10.00														
	Travel Factor	2	1														
Rainfall Intensity =	I = g/(h+T)	4.6	inches per hr														
Peak Discharge =	Q=CIA	3.1	cfs														
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth												
3.00	3.00	0.022	3.96%	4.95 fps	0.45 ft												
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2">Tractive Force</td> <td colspan="4">use temporary liner</td> </tr> <tr> <td>Td= YDS (lb/sf)</td> <td>1.123</td> <td>Straw Netting</td> <td>Td=</td> <td>1.45 lb/sf</td> <td>ok</td> </tr> </table>						Tractive Force		use temporary liner				Td= YDS (lb/sf)	1.123	Straw Netting	Td=	1.45 lb/sf	ok
Tractive Force		use temporary liner															
Td= YDS (lb/sf)	1.123	Straw Netting	Td=	1.45 lb/sf	ok												

SWALE CALCULATIONS for Permanent Swale

Thanksgiving Elementary School

Johnston County, NC

Permanent Swale 3

Outlet Based on 2 year storm

Total watershed area (Ac)		0.47			
Land Type		Rational C	CN	Acres	
Area Impervious		0.95	98	0.000	
denuded with temporary seeding		0.35	73	0.470	
Total watershed area				0.470	
Composite		0.35			
		Overland	Channelized		
Hydraulic Length (ft)		130	276		
Vertical Relief (ft)		5.00	11.00		
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$		Overland	Channelized	Total	If Tc<10, use 10 min
	Time (min)	2.32	2.04	10.00	
	Travel Factor	2	1		
Rainfall Intensity =		I = g/(h+T)	4.6	inches per hr	
Peak Discharge =		Q=CIA	0.8	cfs	
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
3.00	3.00	0.022	3.99%	3.31 fps	0.28 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.688	straw netting =		Td=	1.45 lb/sf ok

SWALE CALCULATIONS for Permanent Swale

Thanksgiving Elementary School

Johnston County, NC

Permanent Swale 4

Outlet Based on 2 year storm

Total watershed area (Ac)		1.27			
Land Type		Rational C	CN	Acres	
Area Impervious		0.95	98	0.000	
denuded with temporary seeding		0.35	73	1.270	
Total watershed area				1.270	
Composite		0.35			
		Overland	Channelized		
Hydraulic Length (ft)		156	354		
Vertical Relief (ft)		2.90	4.10		
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$		Overland	Channelized	Total	If Tc<10, use 10 min
	Time (min)	3.54	3.99	10.00	
	Travel Factor	2	1		
Rainfall Intensity =		I = g/(h+T)	4.6	inches per hr	
Peak Discharge =		Q=CIA	2.0	cfs	
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
3.00	3.00	0.022	1.16%	2.83 fps	0.49 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.355	Jute Netting =	Td=	0.45 lb/sf	ok

SWALE CALCULATIONS for Permanent Swale

Thanksgiving Elementary School

Johnston County, NC

Permanent Swale 5

Outlet Based on 2 year storm

Total watershed area (Ac)		0.38			
Land Type		Rational C	CN	Acres	
Area Impervious		0.95	98	0.000	
denuded with temporary seeding		0.35	73	0.380	
Total watershed area				0.380	
Composite		0.35			
		Overland	Channelized		
Hydraulic Length (ft)		45	233		
Vertical Relief (ft)		5.20	11.00		
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$		Overland	Channelized	Total	If Tc<10, use 10 min
	Time (min)	0.67	1.68	10.00	
	Travel Factor	2	1		
Rainfall Intensity =		I = g/(h+T)	4.6	inches per hr	
Peak Discharge =		Q=CIA	0.6	cfs	
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
3.00	3.00	0.022	4.72%	3.54 fps	0.24 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.708	Straw Netting		Td=	1.45 lb/sf ok

SWALE CALCULATIONS for Permanent Swale

Thanksgiving Elementary School

Johnston County, NC

Permanent Swale 6

Outlet Based on 2 year storm

Total watershed area (Ac)		0.22			
Land Type		Rational C	CN	Acres	
Area Impervious		0.95	98	0.000	
denuded with temporary seeding		0.35	73	0.220	
Total watershed area				0.220	
Composite		0.35			
		Overland	Channelized		
Hydraulic Length (ft)		46	110		
Vertical Relief (ft)		1.00	1.00		
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$		Overland	Channelized	Total	If Tc<10, use 10 min
	Time (min)	1.30	1.77	10.00	
	Travel Factor	2	1		
Rainfall Intensity =		I = g/(h+T)	4.6	inches per hr	
Peak Discharge =		Q=CIA	0.4	cfs	
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
3.00	3.00	0.022	0.91%	1.50 fps	0.28 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.160	Jute Netting		Td=	0.45 lb/sf ok

SWALE CALCULATIONS for Permanent Swale

Thanksgiving Elementary School

Johnston County, NC

Permanent Swale 7

Outlet Based on 2 year storm

Total watershed area (Ac)		0.26			
Land Type		Rational C	CN	Acres	
Area Impervious		0.95	98	0.000	
denuded with temporary seeding		0.35	73	0.260	
Total watershed area				0.260	
Composite		0.35			
		Overland	Channelized		
Hydraulic Length (ft)		59	107		
Vertical Relief (ft)		15.00	1.00		
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$		Overland	Channelized	Total	If Tc<10, use 10 min
	Time (min)	0.61	1.72	10.00	
	Travel Factor	2	1		
Rainfall Intensity =		I = g/(h+T)	4.6	inches per hr	
Peak Discharge =		Q=CIA	0.4	cfs	
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
3.00	3.00	0.022	0.94%	1.79 fps	0.28 ft
Tractive Force					
Td= YDS (lb/sf)	0.164	use te Jute Netting Td= 0.45 lb/sf ok			

SWALE CALCULATIONS for Permanent Swale

Thanksgiving Elementary School

Johnston County, NC

Permanent Swale 8

Outlet Based on 2 year storm

Total watershed area (Ac)		0.72			
Land Type		Rational C	CN	Acres	
Area Impervious		0.95	98	0.000	
denuded with temporary seeding		0.35	73	0.720	
Total watershed area				0.720	
Composite		0.35			
		Overland	Channelized		
Hydraulic Length (ft)		20	391		
Vertical Relief (ft)		12.50	15.50		
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$		Overland	Channelized	Total	If Tc<10, use 10 min
	Time (min)	0.19	2.68	10.00	
	Travel Factor	2	1		
Rainfall Intensity =		I = g/(h+T)	4.6	inches per hr	
Peak Discharge =		Q=CIA	1.2	cfs	
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
3.00	3.00	0.022	3.96%	3.73 fps	0.32 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.797	Straw Netting		Td=	1.45 lb/sf ok

SWALE CALCULATIONS for Permanent Swale

Thanksgiving Elementary School

Johnston County, NC

Permanent Swale 9

Outlet Based on 2 year storm

Total watershed area (Ac)		0.26			
Land Type		Rational C	CN	Acres	
Area Impervious		0.95	98	0.000	
denuded with temporary seeding		0.35	73	0.260	
Total watershed area				0.260	
Composite		0.35			
		Overland	Channelized		
Hydraulic Length (ft)		38	200		
Vertical Relief (ft)		0.50	1.70		
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$		Overland	Channelized	Total	If Tc<10, use 10 min
	Time (min)	1.36	2.89	10.00	
	Travel Factor	2	1		
Rainfall Intensity =		I = g/(h+T)	4.6	inches per hr	
Peak Discharge =		Q=CIA	0.4	cfs	
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
3.00	3.00	0.022	0.85%	1.73 fps	0.28 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.151	Jute Netting =		Td=	0.45 lb/sf ok

SWALE CALCULATIONS for Permanent Swale

Thanksgiving Elementary School

Johnston County, NC

Permanent Swale 10

Outlet Based on 2 year storm

Total watershed area (Ac)		0.76			
Land Type		Rational C	CN	Acres	
Area Impervious		0.95	98	0.000	
denuded with temporary seeding		0.35	73	0.760	
Total watershed area				0.760	
Composite		0.35			
	Overland	Channelized			
Hydraulic Length (ft)	76	221			
Vertical Relief (ft)	4.00	2.70			
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$ <div style="display: flex; justify-content: space-between;"> <div>Time (min)</div> <div>Travel Factor</div> </div>	Overland	Channelized	Total	If Tc<10, use 10 min	
	1.35	2.71	10.00		
	2	1			
Rainfall Intensity =	I = g/(h+T)	4.6	inches per hr		
Peak Discharge =	Q=CIA	1.2	cfs		
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
3.00	3.00	0.022	1.22%	2.54 fps	0.40 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.307	Jute Netting	Td=	0.45 lb/sf	ok

SWALE CALCULATIONS for Permanent Swale

Thanksgiving Elementary School

Johnston County, NC

Permanent Swale 11

Outlet Based on 2 year storm

Total watershed area (Ac)		0.61			
Land Type		Rational C	CN	Acres	
Area Impervious		0.95	98	0.000	
denuded with temporary seeding		0.35	73	0.610	
Total watershed area				0.610	
Composite		0.35			
	Overland	Channelized			
Hydraulic Length (ft)	88	306			
Vertical Relief (ft)	1.00	5.50			
Time of Concentration					
$t_c = \left[\frac{L^3}{H} \right]^{0.385}$	Overland	Channelized	Total	If Tc<10, use 10 min	
	2.73	3.01	10.00		
	Travel Factor	2	1		
Rainfall Intensity =	I = g/(h+T)	4.6	inches per hr		
Peak Discharge =	Q=CIA	1.0	cfs		
Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
3.00	3.00	0.022	1.80%	2.69 fps	0.35 ft
Tractive Force		use temporary liner			
Td= YDS (lb/sf)	0.391	Jute Netting =	Td=	0.45 lb/sf	ok

**APPENDIX
PIPE
CALCULATIONS**

IDF Curve - Rainfall Intensity

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Johnston County, NC

Input Data from NOAA					
	Average recurrence interval (years)				
T (min)	1	2	10	25	100
10	0.66	0.77	0.99	1.10	1.28
15	0.83	0.97	1.25	1.40	1.62
30	1.14	1.34	1.82	2.07	2.48

Calculation of Design Rainfall Intensity, i , using the equation: $i = g/(h + T)$

1 yr

Data from IDF graph		
T, min	i, in/hr	1/i, hr/in
10	3.96	0.25
15	3.32	0.30
30	2.28	0.44

Equation Constants (g & h)	
Slope = $1/g$	0.0093
Intercept = h/g	0.1608
$g = 1/\text{slope}$	107.9
$h = g \cdot \text{intercept}$	17.3

2 yr

Data from IDF graph		
T, min	i, in/hr	1/i, hr/in
10	4.62	0.22
15	3.88	0.26
30	2.68	0.37

Equation Constants (g & h)	
Slope = $1/g$	0.0078
Intercept = h/g	0.1394
$g = 1/\text{slope}$	128.2
$h = g \cdot \text{intercept}$	17.9

10 yr

Data from IDF graph		
T, min	i, in/hr	1/i, hr/in
10	5.94	0.17
15	5.00	0.20
30	3.64	0.27

Equation Constants (g & h)	
Slope = $1/g$	0.0052
Intercept = h/g	0.1183
$g = 1/\text{slope}$	190.8
$h = g \cdot \text{intercept}$	22.6

25 yr

Data from IDF graph		
T, min	i, in/hr	1/i, hr/in
10	6.60	0.15
15	5.60	0.18
30	4.14	0.24

Equation Constants (g & h)	
Slope = $1/g$	0.0044
Intercept = h/g	0.1093
$g = 1/\text{slope}$	225.7
$h = g \cdot \text{intercept}$	24.7

100 yr

Data from IDF graph		
T, min	i, in/hr	1/i, hr/in
10	7.68	0.13
15	6.48	0.15
30	4.96	0.20

Equation Constants (g & h)	
Slope = $1/g$	0.0035
Intercept = h/g	0.0984
$g = 1/\text{slope}$	287.9
$h = g \cdot \text{intercept}$	28.3

Pipe Calculations

						Intensity		Pipe Data											
Name	Design Storm Return Period (Years)	Drainage Areas	Area (ac)	C	T _c (min)	I (in/hr)	Q = CIA (cfs)	Type	N	Beginning Invert (ft)	Ending Invert (ft)	L (ft)	% Slope	Size (in)	# of Pipes	Velocity (ft/sec)	Q Avail. (cfs)	Flow Type	
DI 11 - DI 10	10	11	0.54	0.92	10.00	5.86	2.91	RCP	0.012	260.00	259.40	56	1.1	15	x	1	5.89	7.26	Open Channel
DI 10 - MH 10	10	10,11	0.72	0.74	10.16	5.83	3.11	RCP	0.012	259.40	258.35	105	1.0	15	x	1	5.69	7.02	Open Channel
MH 10 - DI 7	10	9,10,11	1.00	0.78	10.47	5.78	4.53	RCP	0.012	258.35	257.30	105	1.0	15	x	1	5.69	7.02	Open Channel
DI 7 - DI 6	10	7,8,9,10,11	1.69	0.80	10.77	5.72	7.70	RCP	0.012	257.30	256.75	56	1.0	15	x	1	5.64	6.95	Culvert
DI 6 - DI 5	10	6,7,8,9,10,11	1.98	0.82	10.94	5.69	9.23	RCP	0.012	256.75	256.10	64	1.0	15	x	1	5.74	7.07	Culvert
DI 5 - CB 4	10	5,6,7,8,9,10,11	2.19	0.83	11.12	5.66	10.31	RCP	0.012	256.10	253.30	268	1.0	18	x	1	6.57	11.66	Open Channel
CB 4 - DI 3	10	4,4A,5,6,7,8,9,10,11	3.36	0.88	11.80	5.55	16.47	RCP	0.012	253.30	252.00	127	1.0	24	x	1	7.88	24.86	Open Channel
DI 3 - CB 2	10	3,4,4A,5,6,7,8,9,10,11	5.61	0.61	12.07	5.51	18.82	RCP	0.012	252.00	251.60	36	1.1	24	x	1	8.21	25.90	Open Channel
CB 2 - JB 1A	10	2,2A,3,4,4A,5,6,7,8,9,10,11	6.70	0.67	12.15	5.50	24.62	RCP	0.012	251.60	241.60	122	8.2	24	x	1	22.30	70.34	Open Channel
JB 1A - FES 1	10	2,2A,3,4,4A,5,6,7,8,9,10,11	6.70	0.67	11.98	5.52	24.74	RCP	0.012	241.60	241	42	1.4	24	x	1	9.31	29.37	Open Channel
DI 9 - DI 10	10	9	0.28	0.90	10.00	5.86	1.48	RCP	0.012	259.84	259.40	44	1.0	15	x	1	5.69	7.02	Open Channel
DI 8 - DI 7	10	8	0.29	0.90	10.00	5.86	1.53	RCP	0.012	257.84	257.30	50	1.1	15	x	1	5.92	7.29	Open Channel
DI 4A - CB 4	10	4A	0.12	0.98	10.00	5.86	0.69	RCP	0.012	260.75	254.30	178	3.6	15	x	1	10.84	13.36	Open Channel
CB 2A CB 2	10	2A	0.22	0.95	10.00	5.86	1.22	RCP	0.012	254.87	251.60	327	1.0	15	x	1	5.69	7.02	Open Channel
CB 21 - CB 20	10	21	0.15	0.80	10.00	5.86	0.70	RCP	0.012	268.80	266.80	26	7.7	15	x	1	15.79	19.46	Open Channel
CB 20 - CB 19	10	20,21	0.26	0.88	10.03	5.85	1.33	RCP	0.012	266.80	258.40	75	11.2	15	x	1	19.06	23.48	Open Channel
CB 19 - CB 17	10	19,20,21	1.10	0.70	10.09	5.84	4.52	RCP	0.012	258.40	256.00	147	1.6	18	x	1	8.22	14.58	Open Channel
CB 17 - CB 16	10	17,19,20,21,22,23,24,25	3.55	0.77	10.39	5.79	15.83	RCP	0.012	256.00	255.20	395	0.2	18	x	1	2.89	5.13	Culvert
CB 16 - DI 14	10	16,17,19,20,21,22,23,24,25,26,27	5.71	0.81	12.67	5.42	24.99	RCP	0.012	255.20	253.90	106	1.2	18	x	1	7.12	12.63	Culvert
DI 14 - CB 13	10	14,16,17,19,20,21,22,23,24,25,26,27,28,29,30	7.58	0.70	12.91	5.38	28.60	RCP	0.012	253.90	252.00	190	1.0	30	x	1	9.04	44.55	Open Channel
CB 13 - JB 12A	10	13,14,16,17,19,20,21,22,23,24,25,26,27,28,29,30	8.12	0.71	13.26	5.33	30.76	RCP	0.012	252.00	241.50	370	2.8	30	x	1	15.23	75.04	Open Channel
JB 12A - FES 12	10	12B,13,14,16,17,19,20,21,22,23,24,25,26,27,28,29,30	10.51	0.60	13.67	5.27	32.94	RCP	0.012	241.50	241.00	57	0.9	30	x	1	8.47	41.72	Open Channel
DI 12B -JB 12A	10	12B	2.39	0.20	13.67	5.27	2.52	RCP	0.012	241.30	241.00	160	0.2	24	x	1	3.37	10.64	Open Channel
DI 25- DI 24	10	25	0.19	0.70	10.00	5.86	0.78	RCP	0.012	259.50	258.90	50	1.2	15		1	6.24	7.69	Open Channel
DI 24 - DI 23	10	24,25	0.29	0.53	10.13	5.83	0.89	RCP	0.012	258.90	257.90	75	1.3	15	x	1	6.58	8.10	Open Channel
DI 23 - CB 22	10	23,24,25	1.06	0.65	10.32	5.80	4.01	RCP	0.012	257.90	256.80	77	1.4	15	x	1	6.81	8.39	Open Channel
CB 22 - DI 17	10	22,23,24,25	1.29	0.71	10.51	5.77	5.29	RCP	0.012	256.80	256.00	25	3.2	15	x	1	10.19	12.55	Open Channel
DI 27 - DI 26	10	27	0.25	0.75	10.55	5.76	1.08	RCP	0.012	259.50	257.80	100	1.7	15	x	1	7.43	9.15	Open Channel
DI 26 - CB 16	10	26,27	0.78	0.82	10.78	5.72	3.65	RCP	0.012	257.80	155.20	93	110.3	15	x	1	59.82	73.69	Open Channel
CB 30 - DI 29	10	30	0.31	0.60	10.00	5.86	1.09	RCP	0.012	263.50	258.40	155	3.3	15	x	1	10.33	12.73	Open Channel
DI 29 - CB 28	10	29,30	0.89	0.34	10.25	5.81	1.76	RCP	0.012	258.40	257.30	50	2.2	18	x	1	9.54	16.92	Open Channel
CB 28 - DI 14	10	28,29,30	1.30	0.45	10.34	5.80	3.42	RCP	0.012	257.30	253.90	118	2.9	24	x	1	13.22	41.71	Open Channel
DI 32 - FES 31	10	32	2.65	0.25	10.00	5.86	3.88	RCP	0.012	257.00	256.00	110	0.9	15	x	1	5.43	6.69	Open Channel
DI 36- DI 35	10	36	0.84	0.30	10.00	5.86	1.48	RCP	0.012	257	256.00	120	0.8	15	x	1	5.20	6.40	Open Channel
DI 35- DI 34	10	35,36	1.11	0.30	10.38	5.79	1.93	RCP	0.012	256.00	255.00	120	0.8	15	x	1	5.20	6.40	Open Channel
DI 34- FES 33	10	34,34A,35,36	3.05	0.27	10.77	5.72	4.74	RCP	0.012	255.00	248.20	217	3.1	18	x	1	11.38	20.20	Open Channel
DI 34A -DI 34	10	34A	1.75	0.25	10.00	5.86	2.56	RCP	0.012	256.00	255.00	72	1.4	15	x	1	6.71	8.27	Open Channel
DI 37 - Headwall	10	37	1.00	0.20	10.00	5.86	1.17	RCP	0.012	268.80	268.35	65	0.7	24		1	6.48	20.44	Open Channel
Struc - FES out	10						14.78	RCP	0.012	238.00	233.00	63	7.9	18	x	1	18.12	32.14	Open Channel

**APPENDIX
STORM WATER
DETENTION ROUTING**



F-0334

107 E. 2nd Street
GREENVILLE, NC 27858
(252) 752-4135

**STORM WATER DETENTION ROUTING
FOR
THANKSGIVING ELEMENTARY SCHOOL
JOHNSTON COUNTY, NORTH CAROLINA**

2/3/2020
10 Year 24-Hour Storm

Site Conditions Predevelopment

Total watershed area					38.95 acres
Transporation	C=	0.95	CN=	98	0.23 acres
Building	C=	0.95	CN=	98	0.00 acres
Managed Pervious Flat Lawn<2%	C=	0.20	CN=	65	0.00 acres
Hay	C=	0.35	CN=	61	11.73 acres
Wooded	C=	0.20	CN=	50	27.71 acres
SCS Soil Group					
Hydraulic Length			10 year storm	B	
Vertical Relief	Overland	1645.00	Channelized		0.00 feet
10 Year Rainfall	Overland	47.50	Channelized		0.00 feet
		13			5.28 inches

Time of Concentration
channel flow

$$t_c = \frac{\left[\frac{L^3}{H} \right]^{0.385}}{128}$$

Composite C =

Overland 18.32 + Channelized 0.00 18.3 minutes

0.25

IDF (intensity-duration-frequency) Equation - Developed from NOAA - Precipitation Frequencies - Johnston County, NC

Rainfall Intensity = $I = \frac{g}{(h + T)}$ $\frac{R}{10}$ $\frac{g}{190.8}$ $\frac{h}{22.6}$ 4.66 inches per hr

Peak Discharge

$$Q = CIA$$

46.00 cfs

Site Conditions Post Development

Total watershed area				38.95 acres
	C=	0.95	CN=	98 4.75 acres
Building	C=	0.95	CN=	98 2.37 acres
Walks	C=	0.95	CN=	98 0.65 acres
Managed Pervious Lawn	C=	0.20	CN=	60 31.18 acres
Wooded	C=	0.20	CN=	40 0.00 acres
SCS Soil Group				B
Hydraulic Length	Overland	270.00	Channelized	1380.00 feet
Vertical Relief	Overland	4.00	Channelized	36.00 feet
10 yr rainfall				5.28 inches

Design Hydrograph Formulation

Composite CN 67.6

$$S = \frac{1000}{CN} - 10$$

4.80

Runoff

$$Q^* = \frac{(P - 0.2S)^2}{P + 0.8S}$$

2.05 inches

Time of Concentration
channel flow (not overland)

$$t_c = \frac{\left[\frac{L^3}{H} \right]^{0.385}}{128}$$

Overland 5.89 + Channelized 8.32 14.2 minutes

Composite C = 0.35

IDF (intensity-duration-frequency) Equation - Developed from NOAA - Precipitation Frequencies - Johnston County, NC

Rainfall Intensity = $I = \frac{g}{(h + T)}$ $\frac{R}{10}$ $\frac{g}{190.8}$ $\frac{h}{22.6}$ 5.18 inches per hr

Peak Discharge

$$Q = CIA$$

70.58 cfs

Time to peak

$$T_p = \frac{Vol}{1.39Q_p}$$

49.2 minutes

Storage Required

$$S = (Q_p - Q_o)T_p$$

(Above 1st inch of runoff pool)

72,522 cf

10 year storm

Allowable release at impoundment (pre-bypass) =		46.00 cfs
Peak rate of inflow at impoundment (pre-bypass) =	14	70.58 cfs
Allowable release at impoundment(post-bypass)=		22.96 cfs
Peak rate of inflow at impoundment (post-bypass) =		47.54 cfs

BYPASSED FLOW

	Area(ac)	C	I(in/hr)	
Roof	0.00	0.95		
Asphalt	0.53	0.95		
Wooded	0.00	0.20		
Grass	19.71	0.20		
Total	20.24	0.22	5.18	

Q_{bypassed}

23.04 cfs

STAGE STORAGE DATA

Elevation	surface area	diff. elev	storage	accum. storage	Elevation	Stage
238.00	-			-	238.00	0
		1.00	8,213			
239.00	16,425			8,213	239.00	1
		1.00	26,088			
240.00	35,750			34,300	240.00	2
		1.00	45,463			
241.00	55,175			79,763	241.00	3
		1.00	56,851			
242.00	58,527			136,614	242.00	4
		1.00	60,142			
243.00	61,757			196,756	243.00	5
		1.00	63,329			
244.00	64,900			260,084	244.00	6

Storage elevation@minimum storage volume 240.84 msl

Storage	Stage	LN(storage)	LN(Stage)	Z Computed Stage
79,763	3			2.77
136,614	4	11.82	1.39	3.94
196,756	5	12.19	1.61	5.00
260,084	6	12.47	1.79	6.00

$$b = \frac{\ln\left(\frac{S_2}{S_1}\right)}{\ln\left(\frac{Z_2}{Z_1}\right)}$$

1.53

$$K_s = \frac{S_2}{Z_2^b}$$

16,755.39

$$Z = \left[\frac{S}{K_s}\right]^{1/b}$$

24.21

240.84 feet msl

Size Outlet Device for Control Structure

invert elevation	=	238.00 feet msl
estimated orifice center elev.	=	238.75 feet msl
proposed water surface elev.	=	240.84 feet msl
Average head (h)	=	0.95 feet
discharge (d)	=	23.0 cfs
coefficient of discharge	=	0.6

Orifice equation

$Q = C_d A \sqrt{2gh}$	10 year storm	2.50 inches	estimated based on 10 yr
	15 SAY	18 inches	try based on 1 yr

Inflow Hydrograph

Peak Inflow =
Time to Peak =

70.58
49.2 min

47.54
61

Time T (min)	Inflow Q (cfs)	Orifice Outflow Q (cfs)	Temp Outflow Q (cfs)	Structure Overflow Q (cfs)	Total Outflow Q (cfs)
0	0.00	0.00	0.00	0.0	0.0
3.00	0.43	0.00	0.00	0.0	0.0
6.00	1.72	0.00	0.00	0.0	0.0
9.00	3.82	0.00	0.00	0.0	0.0
12.00	6.64	3.51	0.00	0.0	3.5
15.00	10.09	3.99	0.00	0.0	4.0
18.00	14.04	4.74	0.00	0.0	4.7
21.00	18.35	5.51	0.00	0.0	5.5
24.00	22.86	6.31	0.00	0.0	6.3
27.00	27.40	7.12	0.00	0.0	7.1
30.00	31.80	7.89	0.00	0.0	7.9
33.00	35.91	8.63	0.00	0.0	8.6
36.00	39.58	9.35	0.00	0.0	9.4
39.00	42.67	10.06	0.00	0.0	10.1
42.00	45.07	10.69	0.00	0.0	10.7
45.00	46.69	11.31	0.00	0.0	11.3
48.00	47.47	11.88	0.00	0.0	11.9
51.00	47.38	12.38	0.00	0.0	12.4
54.00	46.43	12.84	0.00	0.0	12.8
57.00	44.65	13.26	0.00	0.0	13.3
60.00	42.11	13.63	0.00	0.0	13.6
63.00	38.90	13.92	0.00	0.0	13.9
66.00	36.04	14.21	0.00	0.0	14.2
69.00	33.29	14.41	0.00	0.0	14.4
72.00	30.76	14.58	0.00	0.0	14.6
75.00	28.41	14.71	0.00	0.0	14.7
78.00	26.25	14.75	0.00	0.0	14.8
81.00	24.24	14.78	0.00	0.0	14.8
84.00	22.40	14.78	0.00	0.0	14.8
87.00	20.69	14.73	0.00	0.0	14.7
90.00	19.11	14.63	0.00	0.0	14.6
93.00	17.65	14.53	0.00	0.0	14.5
96.00	16.31	14.56	0.00	0.0	14.6
99.00	15.06	14.58	0.00	0.0	14.6
102.00	13.92	14.58	0.00	0.0	14.6
105.00	12.86	14.58	0.00	0.0	14.6
108.00	11.88	14.56	0.00	0.0	14.6
111.00	10.97	14.53	0.00	0.0	14.5
114.00	10.13	14.48	0.00	0.0	14.5
117.00	9.36	14.46	0.00	0.0	14.5
120.00	8.65	14.41	0.00	0.0	14.4
123.00	7.99	14.33	0.00	0.0	14.3
126.00	7.38	14.28	0.00	0.0	14.3
129.00	6.82	14.21	0.00	0.0	14.2
132.00	6.30	14.13	0.00	0.0	14.1
135.00	5.82	14.05	0.00	0.0	14.1
138.00	5.37	13.95	0.00	0.0	13.9
141.00	4.96	13.87	0.00	0.0	13.9
144.00	4.58	13.77	0.00	0.0	13.8
147.00	4.24	13.66	0.00	0.0	13.7
150.00	3.91	13.55	0.00	0.0	13.6
153.00	3.61	13.45	0.00	0.0	13.4
156.00	3.34	13.34	0.00	0.0	13.3
159.00	3.08	13.20	0.00	0.0	13.2
162.00	2.85	13.09	0.00	0.0	13.1
165.00	2.63	12.95	0.00	0.0	13.0
168.00	2.43	12.84	0.00	0.0	12.8
171.00	2.25	12.70	0.00	0.0	12.7
174.00	2.07	12.56	0.00	0.0	12.6
177.00	1.92	12.41	0.00	0.0	12.4
180.00	1.77	12.27	0.00	0.0	12.3
183.00	1.64	12.12	0.00	0.0	12.1
186.00	1.51	11.97	0.00	0.0	12.0
189.00	1.40	11.81	0.00	0.0	11.8
192.00	1.29	11.66	0.00	0.0	11.7
195.00	1.19	11.50	0.00	0.0	11.5
198.00	1.10	11.31	0.00	0.0	11.3

10-year storm
16

201.00	1.02	11.15	0.00	0.0	11.2
204.00	0.94	10.99	0.00	0.0	11.0
207.00	0.87	10.79	0.00	0.0	10.8
210.00	0.80	10.62	0.00	0.0	10.6
213.00	0.74	10.42	0.00	0.0	10.4
216.00	0.68	10.24	0.00	0.0	10.2
219.00	0.63	10.03	0.00	0.0	10.0
222.00	0.58	9.81	0.00	0.0	9.8
225.00	0.54	9.62	0.00	0.0	9.6
228.00	0.50	9.39	0.00	0.0	9.4

Stormwater routing

T (time min)	Q (cfs)	Storage	Stage	Outflow	Elevation	18 inch Orifice	100.00 top of dam 245.00 Weir	20.00 Emg Spill 243.00 Weir
0	0	-	0.00	0.00	238.00			
3.00	0.4	-	0.00	0.00	238.00	0.00	0.0	0.00
6.00	1.7	78	0.03	0.00	238.03	0.00	0.0	0.00
9.00	3.8	388	0.09	0.00	238.09	0.00	0.0	0.00
12.00	6.6	1,076	0.17	3.51	238.17	3.51	0.0	0.00
15.00	10.1	1,640	0.22	3.99	238.22	3.99	0.0	0.00
18.00	14.0	2,739	0.31	4.74	238.31	4.74	0.0	0.00
21.00	18.4	4,415	0.42	5.51	238.42	5.51	0.0	0.00
24.00	22.9	6,726	0.55	6.31	238.55	6.31	0.0	0.00
27.00	27.4	9,705	0.70	7.12	238.70	7.12	0.0	0.00
30.00	31.8	13,355	0.86	7.89	238.86	7.89	0.0	0.00
33.00	35.9	17,660	1.03	8.63	239.03	8.63	0.0	0.00
36.00	39.6	22,571	1.21	9.35	239.21	9.35	0.0	0.00
39.00	42.7	28,012	1.40	10.06	239.40	10.06	0.0	0.00
42.00	45.1	33,881	1.58	10.69	239.58	10.69	0.0	0.00
45.00	46.7	40,069	1.77	11.31	239.77	11.31	0.0	0.00
48.00	47.5	46,436	1.95	11.88	239.95	11.88	0.0	0.00
51.00	47.4	52,843	2.12	12.38	240.12	12.38	0.0	0.00
54.00	46.4	59,143	2.28	12.84	240.28	12.84	0.00	0.00
57.00	44.7	65,189	2.43	13.26	240.43	13.26	0.00	0.00
60.00	42.1	70,840	2.57	13.63	240.57	13.63	0.00	0.00
63.00	38.9	75,966	2.68	13.92	240.68	13.92	0.00	0.00
66.00	35.1	80,461	2.79	14.21	240.79	14.21	0.00	0.00
69.00	30.9	84,227	2.87	14.41	240.87	14.41	0.00	0.00
72.00	26.5	87,204	2.94	14.58	240.94	14.58	0.00	0.00
75.00	22.0	89,349	2.99	14.71	240.99	14.71	0.00	0.00
78.00	17.5	90,654	3.01	14.75	241.01	14.75	0.00	0.00
81.00	13.2	91,144	3.02	14.78	241.02	14.78	0.00	0.00
84.00	9.4	90,865	3.02	14.78	241.02	14.78	0.00	0.00
87.00	6.0	89,890	3.00	14.73	241.00	14.73	0.00	0.00
90.00	3.3	88,324	2.96	14.63	240.96	14.63	0.00	0.00
93.00	17.7	86,292	2.92	14.53	240.92	14.53	0.00	0.00
96.00	16.3	86,854	2.93	14.56	240.93	14.56	0.00	0.00
99.00	15.1	87,169	2.94	14.58	240.94	14.58	0.00	0.00
102.00	13.9	87,256	2.94	14.58	240.94	14.58	0.00	0.00
105.00	12.9	87,136	2.94	14.58	240.94	14.58	0.00	0.00
108.00	11.9	86,825	2.93	14.56	240.93	14.56	0.00	0.00
111.00	11.0	86,342	2.92	14.53	240.92	14.53	0.00	0.00
114.00	10.1	85,701	2.90	14.48	240.90	14.48	0.00	0.00
117.00	9.4	84,918	2.89	14.46	240.89	14.46	0.00	0.00
120.00	8.6	84,001	2.87	14.41	240.87	14.41	0.00	0.00
123.00	8.0	82,964	2.84	14.33	240.84	14.33	0.00	0.00
126.00	7.4	81,822	2.82	14.28	240.82	14.28	0.00	0.00
129.00	6.8	80,579	2.79	14.21	240.79	14.21	0.00	0.00
132.00	6.3	79,249	2.76	14.13	240.76	14.13	0.00	0.00
135.00	5.8	77,839	2.73	14.05	240.73	14.05	0.00	0.00
138.00	5.4	76,357	2.69	13.95	240.69	13.95	0.00	0.00
141.00	5.0	74,814	2.66	13.87	240.66	13.87	0.00	0.00
144.00	4.6	73,210	2.62	13.77	240.62	13.77	0.00	0.00
147.00	4.2	71,558	2.58	13.66	240.58	13.66	0.00	0.00
150.00	3.9	69,861	2.54	13.55	240.54	13.55	0.00	0.00
153.00	3.6	68,126	2.50	13.45	240.50	13.45	0.00	0.00
156.00	3.3	66,356	2.46	13.34	240.46	13.34	0.00	0.00
159.00	3.1	64,556	2.41	13.20	240.41	13.20	0.00	0.00
162.00	2.8	62,735	2.37	13.09	240.37	13.09	0.00	0.00
165.00	2.6	60,891	2.32	12.95	240.32	12.95	0.00	0.00
168.00	2.4	59,033	2.28	12.84	240.28	12.84	0.00	0.00
171.00	2.2	57,159	2.23	12.70	240.23	12.70	0.00	0.00
174.00	2.1	55,277	2.18	12.56	240.18	12.56	0.00	0.00

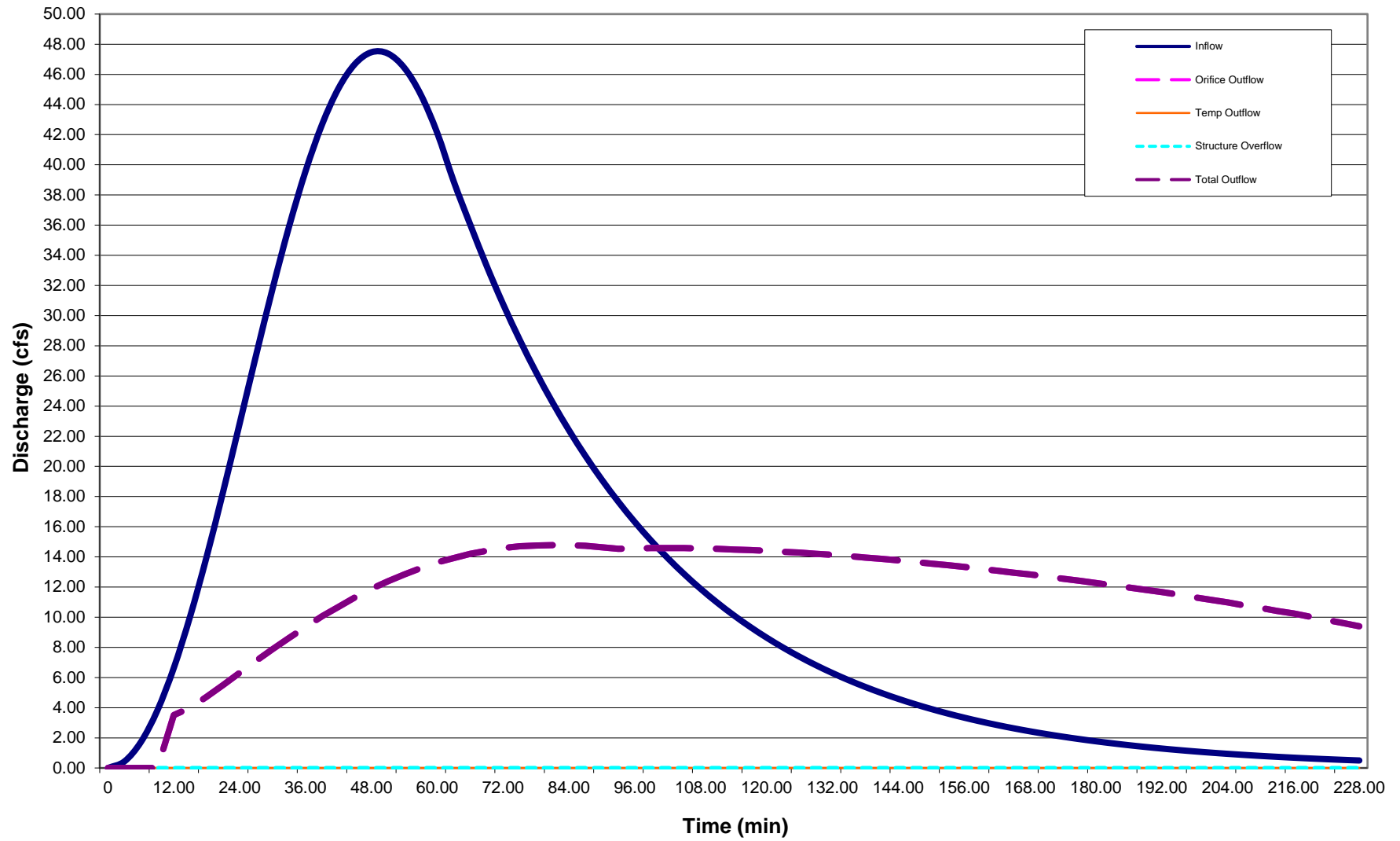
10 year storm
17

177.00	1.9	53,391	2.13	12.41	240.13	12.41	0.00	0.00
180.00	1.8	51,501	2.08	12.27	240.08	12.27	0.00	0.00
183.00	1.6	49,612	2.03	12.12	240.03	12.12	0.00	0.00
186.00	1.5	47,726	1.98	11.97	239.98	11.97	0.00	0.00
189.00	1.4	45,843	1.93	11.81	239.93	11.81	0.00	0.00
192.00	1.3	43,968	1.88	11.66	239.88	11.66	0.00	0.00
195.00	1.2	42,101	1.83	11.50	239.83	11.50	0.00	0.00
198.00	1.1	40,245	1.77	11.31	239.77	11.31	0.00	0.00
201.00	1.0	38,406	1.72	11.15	239.72	11.15	0.00	0.00
204.00	0.9	36,581	1.67	10.99	239.67	10.99	0.00	0.00
207.00	0.9	34,772	1.61	10.79	239.61	10.79	0.00	0.00
210.00	0.8	32,986	1.56	10.62	239.56	10.62	0.00	0.00
213.00	0.7	31,218	1.50	10.42	239.50	10.42	0.00	0.00
216.00	0.7	29,476	1.45	10.24	239.45	10.24	0.00	0.00
219.00	0.6	27,756	1.39	10.03	239.39	10.03	0.00	0.00
222.00	0.6	26,065	1.33	9.81	239.33	9.81	0.00	0.00
225.00	0.5	24,404	1.28	9.62	239.28	9.62	0.00	0.00
228.00	0.5	22,769	1.22	9.39	239.22	9.39	0.00	0.00

Results of routing the 10 Year storm

Use orifice =	18.00 inches		
Peak outflow =	14.78 cfs	Less than Predeveloped Flow =	22.96 cfs
Peak Stage=	3.02 ft		
Water Elevation=	241.02 fmsl		
Peak Storage =	91,144 cf		
Top of Dam	245.00 fmsl		
Length of Weir	100.00 ft		
Weir elevation	243.00 fmsl		
Length of weir	20.00 ft		

Routing Hydrograph (10-YR)



**APPENDIX
RIP-RAP
CALCULATIONS**

Rivers & Associates

102 E. Second Street
Greenville, NC 27834
252-752-4135

JOB Thanksgiving Elementary School - JB 1A to FES 1

SHEET NO.

OF

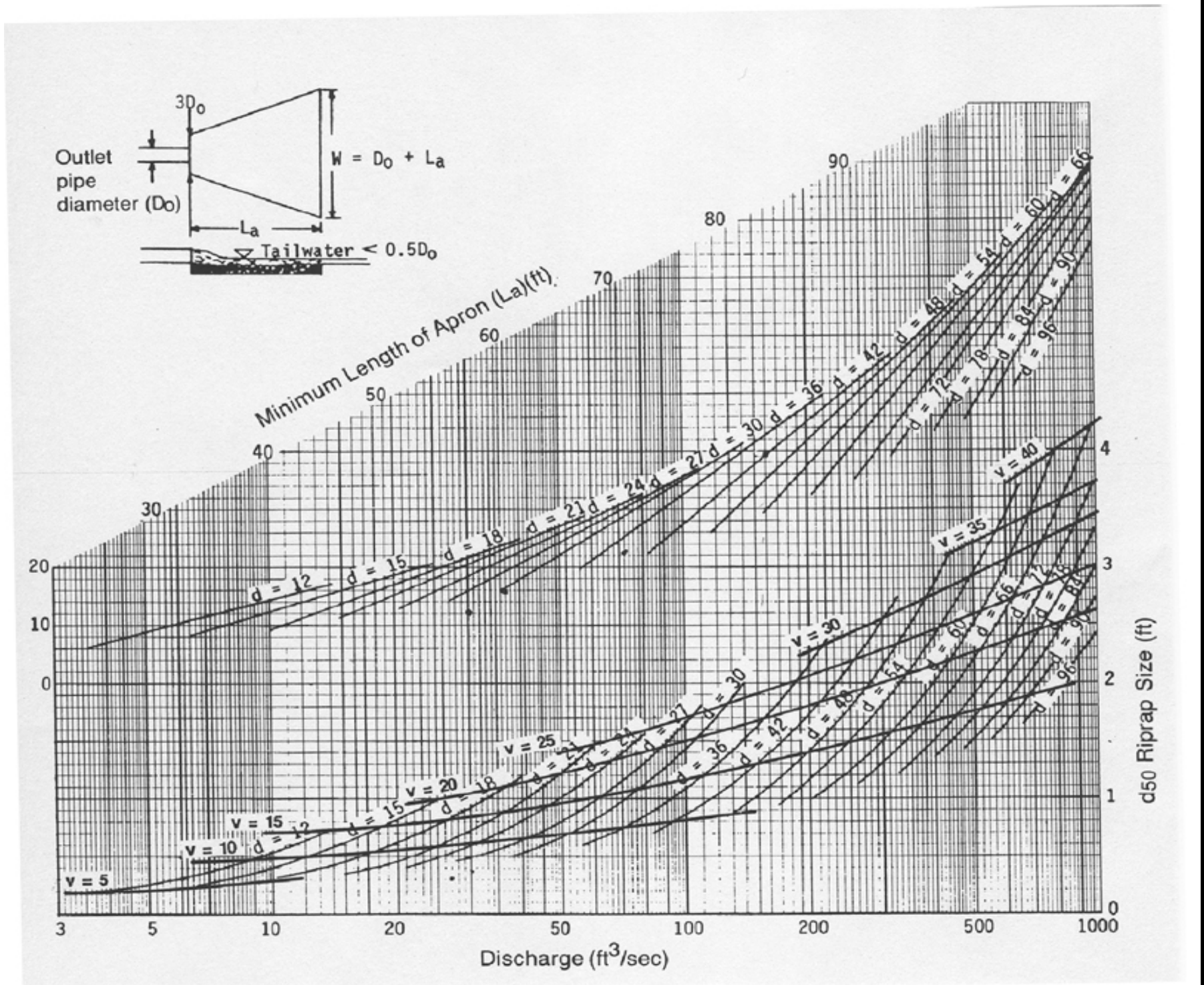
CALCULATED BY DH

DATE 2/6/2020

CHECKED BY JSJ

DATE 2/6/2020

SCALE nts



Given Information

$Q_{10} = 24.74$ cfs

$D_o = 24$ "

Class 'B' stone unit weight = 110 pcf

Is flow below minimum for Pipe Diameter: YES

If flow is higher, then chart consultation is needed

Calculated Information

Width at entrance = $3D_o = 6$ ft use 6.0 ft

Width at exit ($D_o + 0.4xL_a$) = 6.8 ft use 7.0 ft

Length of Apron (from chart) $L = 12$ ft

Thickness = 18 " thick Class 'B' stone

Tonnage = 6.435 tons use 7 tons

Apron at FES 1

Use 6 ft x 7 ft x 12 ft, 7 tons.

Rivers & Associates

102 E. Second Street
Greenville, NC 27834
252-752-4135

JOB Thanksgiving Elementary School - JB 12A to FES 12

SHEET NO.

OF

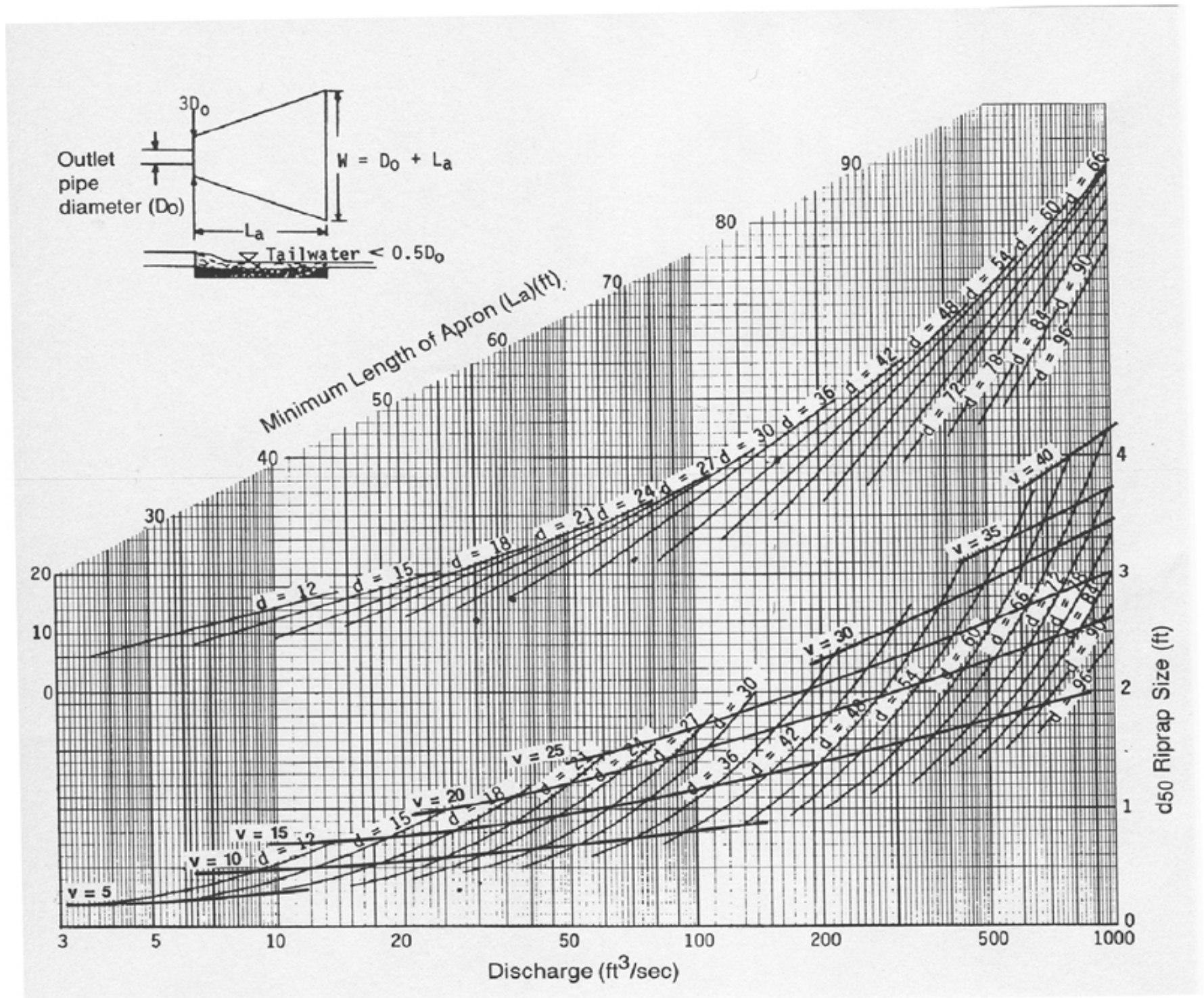
CALCULATED BY DH

DATE 2/6/2020

CHECKED BY JSJ

DATE 2/6/2020

SCALE nts



Given Information

$Q_{10} = 33.60$ cfs

$D_o = 30$ "

Class 'B' stone unit weight = 110 pcf

Is flow below minimum for Pipe Diameter: YES

If flow is higher, then chart consultation is needed

Calculated Information

Width at entrance = $3D_o = 7.5$ ft use 8.0 ft

Width at exit ($D_o + 0.4 \times L_a$) = 8.9 ft use 9.0 ft

Length of Apron (from chart) $L = 16$ ft

Thickness = 18 " thick Class 'B' stone

Tonnage = 11.22 tons use 12 tons

Apron at FES 12

Use 8 ft x 9 ft x 16 ft, 12 tons.

Rivers & Associates

102 E. Second Street
Greenville, NC 27834
252-752-4135

JOB Thanksgiving Elementary School - DI 32 to FES 31

SHEET NO.

OF

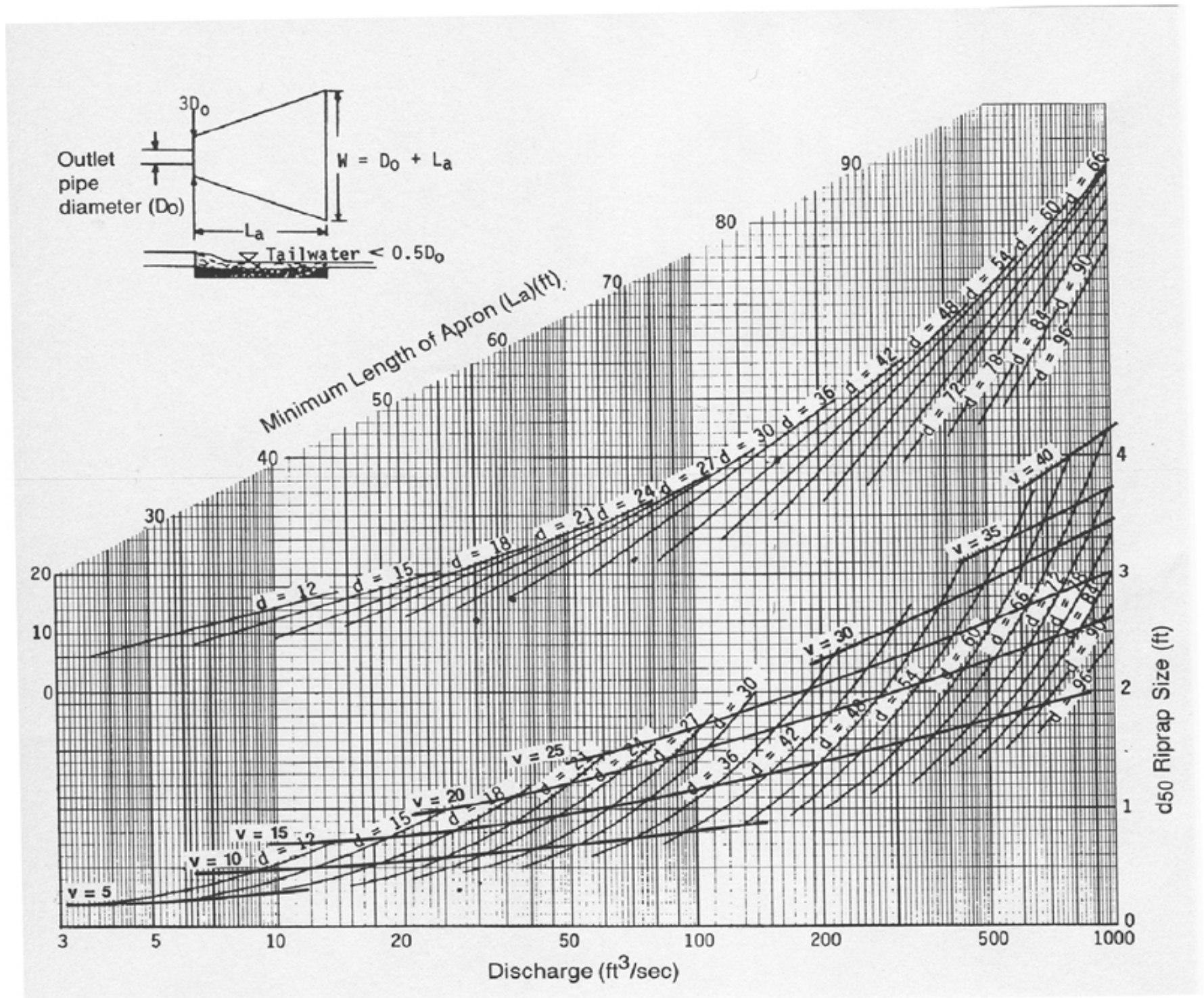
CALCULATED BY DH

DATE 2/6/2020

CHECKED BY JSJ

DATE 2/6/2020

SCALE nts



Given Information

$Q_{10} = 3.88$ cfs

$D_o = 15$ "

Class 'B' stone unit weight = 110 pcf

Is flow below minimum for Pipe Diameter: YES

If flow is higher, then chart consultation is needed

Calculated Information

Width at entrance = $3D_o = 3.75$ ft use 4.0 ft

Width at exit ($D_o + 0.4 \times L_a$) = 3.25 ft use 4.0 ft

Length of Apron (from chart) $L = 5$ ft

Thickness = 18 " thick Class 'B' stone

Tonnage = 1.65 tons use 2 tons

Apron at FES 31

Use 4 ft x 4 ft x 5 ft, 2 tons.

Rivers & Associates

102 E. Second Street
Greenville, NC 27834
252-752-4135

JOB Thanksgiving Elementary School - DI 34 to FES 33

SHEET NO.

OF

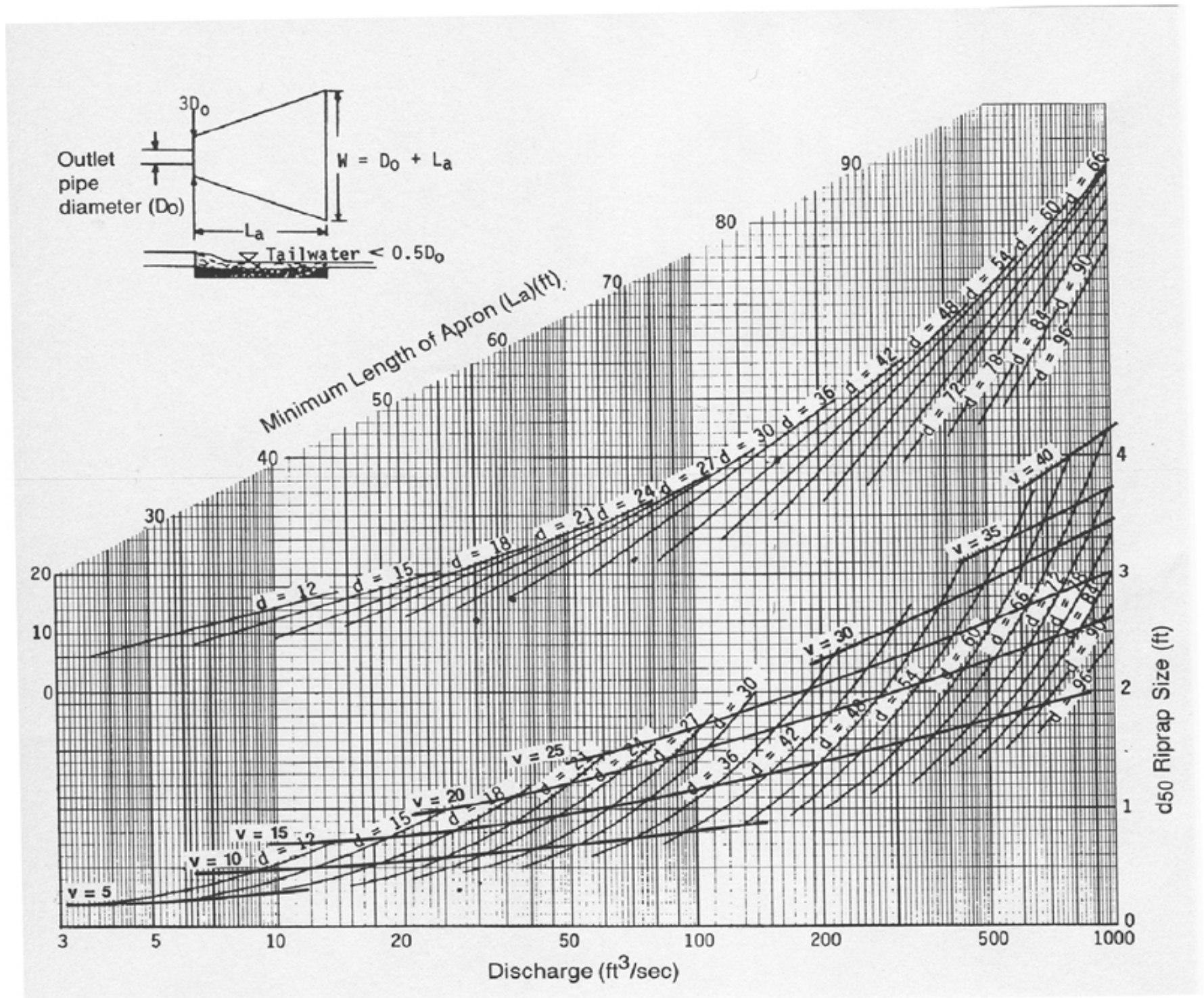
CALCULATED BY DH

DATE 2/6/2020

CHECKED BY JSJ

DATE 2/6/2020

SCALE nts



Given Information

$Q_{10} = 4.77$ cfs

$D_o = 15$ "

Class 'B' stone unit weight = 110 pcf

Is flow below minimum for Pipe Diameter: YES

If flow is higher, then chart consultation is needed

Calculated Information

Width at entrance = $3D_o = 3.75$ ft use 4.0 ft

Width at exit ($D_o + 0.4 \times L_a$) = 3.25 ft use 4.0 ft

Length of Apron (from chart) $L = 5$ ft

Thickness = 18 " thick Class 'B' stone

Tonnage = 1.65 tons use 2 tons

Apron at FES 33

Use 4 ft x 4 ft x 5 ft, 2 tons.

Rivers & Associates

102 E. Second Street
Greenville, NC 27834
252-752-4135

JOB Thanksgiving Elementary School - CONTR STR to FES OUT

SHEET NO.

OF

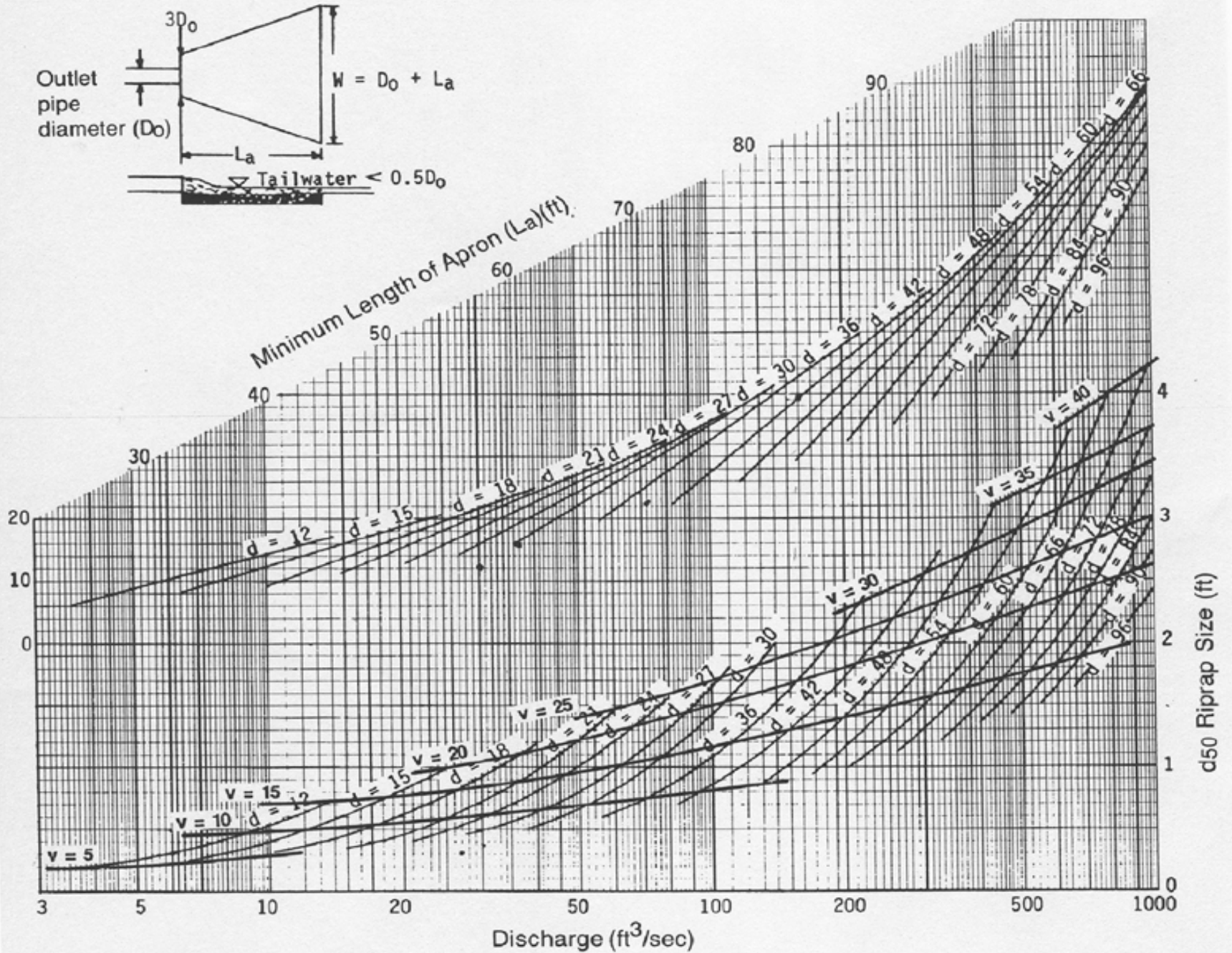
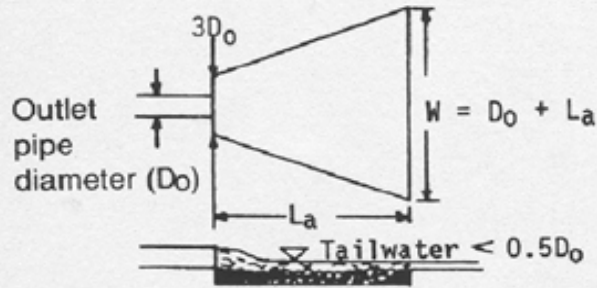
CALCULATED BY DH

DATE 2/6/2020

CHECKED BY JSJ

DATE 2/6/2020

SCALE nts



Given Information

$Q_{10} = 14.78$ cfs

$D_o = 18$ "

Class 'B' stone unit weight = 110 pcf

Is flow below minimum for Pipe Diameter: YES

If flow is higher, then chart consultation is needed

Calculated Information

Width at entrance = $3D_o = 4.5$ ft use 5.0 ft

Width at exit ($D_o + 0.4xL_a$) = 7.1 ft use 8.0 ft

Length of Apron (from chart) $L = 14$ ft

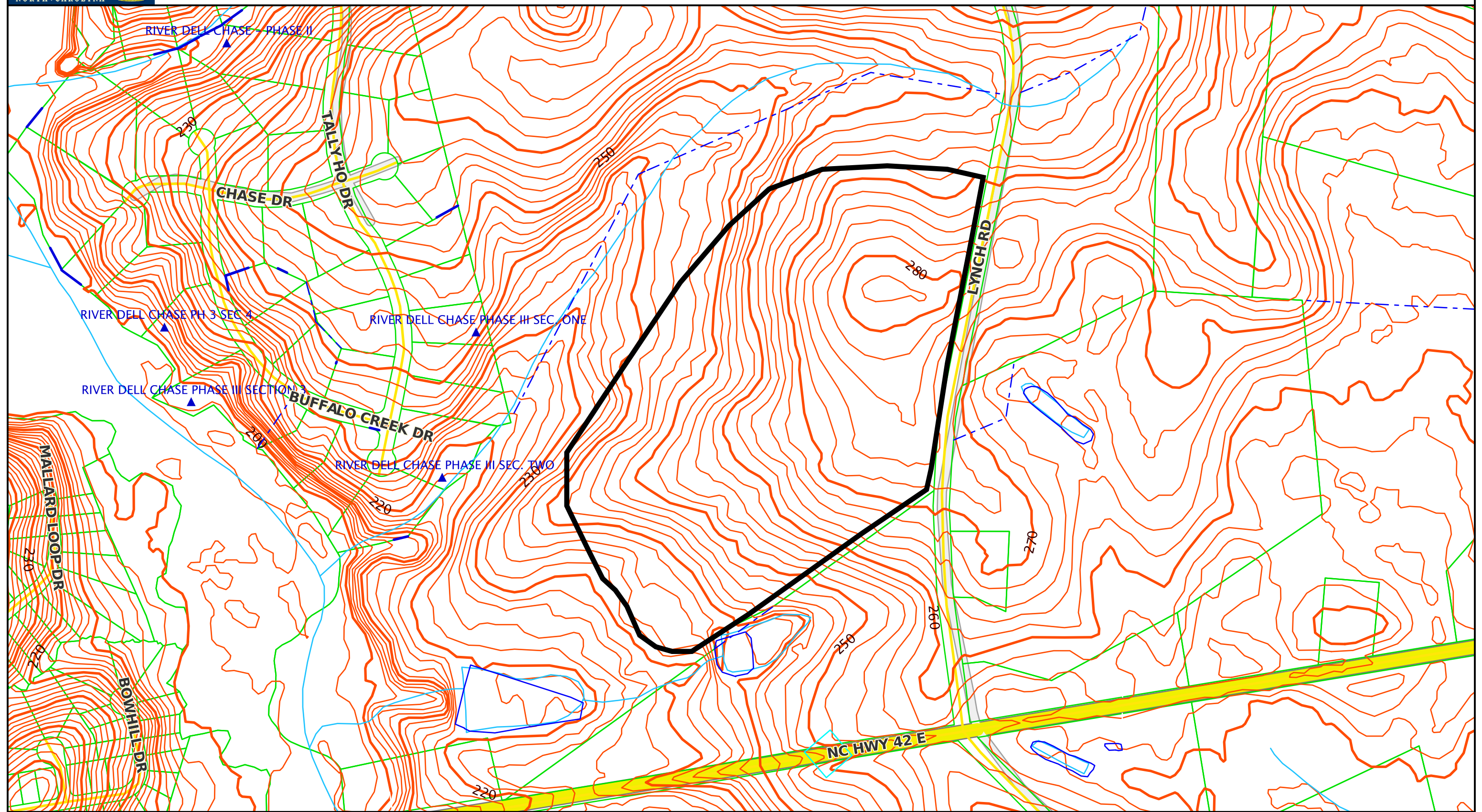
Thickness = 18 " thick Class 'B' stone

Tonnage = 7.5075 tons use 8 tons

Apron at FES 8

Use 5 ft x 8 ft x 14 ft, 8 tons.

APPENDIX
CORRESPONDANCE
SOILS MAP
TOPOGRAPHIC QUAD MAP



Scale: 1:4082 - 1 in. = 340.14 feet
(The scale is only accurate when printed landscape on a 11 x 17 size sheet with no page scaling.)



United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Johnston County, North Carolina



February 6, 2020

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

78° 19' 39" W

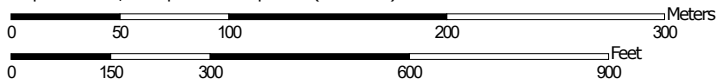
Soil Map

78° 19' 17" W



Soil Map may not be valid at this scale.

Map Scale: 1:3,470 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop


 Saline Spot

 Sandy Spot

 Severely Eroded Spot


 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Johnston County, North Carolina

Survey Area Data: Version 23, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 29, 2014—Dec 9, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
GeB	Gilead sandy loam, 2 to 8 percent slopes	5.0	11.9%
Ly	Lynchburg sandy loam, 0 to 2 percent slopes	1.9	4.4%
MaA	Marlboro sandy loam, 0 to 2 percent slopes	8.8	21.2%
MaB	Marlboro sandy loam, 2 to 8 percent slopes	2.2	5.2%
McB	Marlboro-Cecil complex, 2 to 8 percent slopes	23.2	55.6%
NoB	Norfolk loamy sand, 2 to 6 percent slopes	0.7	1.7%
Totals for Area of Interest		41.8	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Johnston County, North Carolina

GeB—Gilead sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 3t49
Elevation: 80 to 330 feet
Mean annual precipitation: 38 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 210 to 265 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Gilead and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gilead

Setting

Landform: Ridges on marine terraces
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Clayey marine deposits

Typical profile

Ap - 0 to 5 inches: sandy loam
Bt1 - 5 to 15 inches: sandy clay loam
Bt2 - 15 to 29 inches: clay
Btg - 29 to 38 inches: clay loam
Cg - 38 to 80 inches: sandy clay loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.57 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Ly—Lynchburg sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2vx8p
Elevation: 10 to 330 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 200 to 280 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Lynchburg and similar soils: 84 percent
Minor components: 16 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lynchburg

Setting

Landform: Flats on marine terraces, broad interstream divides on marine terraces
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 8 inches: sandy loam
E - 8 to 11 inches: sandy loam
Bt - 11 to 21 inches: sandy clay loam
Btg - 21 to 65 inches: sandy clay loam
BCg - 65 to 85 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Hydric soil rating: No

Minor Components

Rains

Percent of map unit: 8 percent

Custom Soil Resource Report

Landform: Flats on marine terraces, broad interstream divides on marine terraces
Landform position (three-dimensional): Dip, tal^f
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Goldsboro

Percent of map unit: 8 percent
Landform: Flats on marine terraces, broad interstream divides on marine terraces
Landform position (three-dimensional): Tal^f
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

MaA—Marlboro sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 3t4j
Elevation: 80 to 330 feet
Mean annual precipitation: 38 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 210 to 265 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Marlboro and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Marlboro

Setting

Landform: Broad interstream divides on marine terraces, ridges on marine terraces
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Clayey marine deposits

Typical profile

Ap - 0 to 10 inches: sandy loam
Bt1 - 10 to 71 inches: sandy clay
Bt2 - 71 to 80 inches: sandy clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: None

Custom Soil Resource Report

Frequency of ponding: None

Available water storage in profile: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 1

Hydrologic Soil Group: B

Hydric soil rating: No

MaB—Marlboro sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 3t4k

Elevation: 80 to 330 feet

Mean annual precipitation: 38 to 55 inches

Mean annual air temperature: 59 to 70 degrees F

Frost-free period: 210 to 265 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Marlboro and similar soils: 90 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Marlboro

Setting

Landform: Ridges on marine terraces, broad interstream divides on marine terraces

Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Crest

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Clayey marine deposits

Typical profile

Ap - 0 to 10 inches: sandy loam

Bt1 - 10 to 71 inches: sandy clay

Bt2 - 71 to 80 inches: sandy clay

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: About 48 to 72 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Custom Soil Resource Report

Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

McB—Marlboro-Cecil complex, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 3t4l
Elevation: 80 to 330 feet
Mean annual precipitation: 38 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 210 to 265 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Marlboro and similar soils: 45 percent
Cecil and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Marlboro

Setting

Landform: Ridges on marine terraces, broad interstream divides on marine terraces
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Clayey marine deposits

Typical profile

Ap - 0 to 13 inches: sandy loam
Bt1 - 13 to 45 inches: sandy clay
Bt2 - 45 to 88 inches: sandy clay

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Cecil

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite and gneiss

Typical profile

Ap - 0 to 7 inches: gravelly loam
E - 7 to 14 inches: gravelly loam
Bt1 - 14 to 35 inches: clay
Bt2 - 35 to 44 inches: clay loam
BC - 44 to 80 inches: sandy loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

NoB—Norfolk loamy sand, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2v75y
Elevation: 30 to 450 feet
Mean annual precipitation: 38 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 200 to 280 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Norfolk and similar soils: 83 percent
Minor components: 17 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Norfolk

Setting

Landform: Broad interstream divides on marine terraces, flats on marine terraces

Landform position (three-dimensional): Talf

Down-slope shape: Convex, linear

Across-slope shape: Convex, linear

Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 8 inches: loamy sand

E - 8 to 14 inches: loamy sand

Bt - 14 to 65 inches: sandy clay loam

BC - 65 to 80 inches: sandy clay loam

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: About 40 to 72 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: A

Hydric soil rating: No

Minor Components

Wagram

Percent of map unit: 10 percent

Landform: Broad interstream divides on marine terraces, ridges on marine terraces

Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Riser, rise

Down-slope shape: Convex, linear

Across-slope shape: Convex

Hydric soil rating: No

Goldsboro

Percent of map unit: 7 percent

Landform: Flats on marine terraces, broad interstream divides on marine terraces

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

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Custom Soil Resource Report

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

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United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions, and Division-1 Specification sections, apply to work of this section.

GENERAL LANDSCAPE REQUIREMENTS AND ONE YEAR WARRANTY:

Redistribute stockpiled topsoil a minimum of 3" thick layer, to supplement that available for reuse at site.

Provide grown-in turf, or sod turf where indicated. Maintain and warranty complete installation for one year following acceptance.

PRE-EMERGENT HERBICIDE TREATMENT:

Prior to permanent seeding, apply herbicide as recommended by the seed supplier, in accordance with published recommendations.

SEEDING PLAN:

PERMANENT SEEDING AFTER APRIL 15 AND BEFORE SEPTEMBER 15:

Seeding Mixture:

1. Centipede, applied at the rate of 10 lbs. Per acre.
2. Common Bermuda, applied at the rate of 100 lbs. Per acre.

PERMANENT SEEDING AFTER SEPTEMBER 15 AND BEFORE APRIL 15:

Seeding Mixture:

1. Centipede, applied at the rate of 10 lbs. Per acre.
2. Common Bermuda (unhulled), applied at the rate of 100 lbs. Per acre.
3. Annual Rye Grass, applied at the rate of 50 lb. Per acre.

SOD:

Provide centipede sod where indicated on Drawings.

SOIL AMENDMENTS

Apply 3000 lb. / acre ground agricultural limestone and 1,000 lb. / acre of 10-10-10 fertilizer.

MULCH

Use jute, excelsior matting, or other effective channel lining material to cover the bottom of channels, ditches, and swales as required to prevent erosion, and promote turf establishment. Extend lining above the highest calculated depth of flow. On channel side slopes above this height, and in drainages not requiring temporary lining, apply 4000 lb. / acre grain straw by stapling netting over the top.

All other lawn areas shall be mulched with 2,000 lb. / acre grain straw, stitched into ground with a disc harrow with blades set straight.

Provide matting for sloped banks as indicated on Drawings.

TURF ESTABLISHMENT, MAINTENANCE, AND SPECIAL RIGHT OF OWNER TO TAKE CORRECTIVE ACTION

Turf establishment and maintenance includes sufficient irrigation and frequent mowing to promote turf grow-in and to prevent the growth and proliferation of weeds. In addition, the contractor shall re-seed, re-fertilize and mulch immediately following erosion or other damage, which is to be expected. Should the Owner determine that the grounds in part or as a whole lack proper maintenance in accordance with this paragraph, the Owner or his designated agent (the Architect or Engineer) may provide written notice to the Contractor to take corrective action. If the Contractor does not respond with corrective action or otherwise in an acceptable manner to the Owner within five (5) calendar days, the Owner may, at his option, undertake such corrective action with his own or other forces, and deduct the full cost from the Contract amount of the Contractor.

PLANTING GENERAL LAWNS:

Where topsoil has been stripped, redistribute a minimum 3" layer of stockpiled topsoil, add specified soil amendments and mix thoroughly into top 4" of soil, tilling surface to a level, fine texture.

Cultivate to a depth of 6" in areas where topsoil has not been stripped, add specified soil amendments and mix thoroughly into top 4" of soil, tilling surface to a level, fine texture.

Grade and roll prepared lawn surface. Water thoroughly but do not create muddy soil condition.

Hydro-seed uniformly in two directions in the quantity recommended by the seed producer. Water thoroughly with fine spray.

Protect seeded areas against erosion by stitching straw with a disc harrow with blades set straight. Immediately after seeding, protect the area against traffic or other use by erecting barricades as required until final acceptance.

Install sodding where indicated on Drawings. Irrigate as necessary for establishment and maintenance.

LANDSCAPE MATERIALS AND PLANTING:

Comply with detailed drawings and the AMERICAN STANDARD FOR NURSERY STOCK, ANSI Z60.1-1990. Plant materials shall be checked upon delivery to site and before planting in accordance with this standard, and any materials that do not meet specifications will be removed from the site. The contractor shall replace any dead or dying plant materials, or those failing to thrive, that are observed, following acceptance of 12 months install by Owner.

FINAL ACCEPTANCE:

Final Inspection and Acceptance: At the end of the turf establishment period, final inspection will be made upon written request at least 10 days prior to the anticipated date. Final acceptance will be based upon a full stand of turf of the species specified.

Turf establishment period shall be defined as minimum three mowing cycles, or as required to produce a stand of turf. Contractor is responsible for irrigation and mowing as required.

Re-planting: In areas which do not have a satisfactory stand of turf or sod, replace sod or replant, mulch, re-fertilize and irrigate within specified planting dates.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Extent of portland cement concrete paving includes concrete sidewalks, curbs and gutters, as shown on Drawings.

Prepared subbase is specified in Section 02200.

Concrete and related materials are specified in Section 03200.

QUALITY ASSURANCE:

Codes and Standards: Comply with NCDOT Regulations if more stringent than herein specified.

SUBMITTALS:

Furnish samples, manufacturer's product data, test reports, and materials' certifications as required in referenced sections for concrete and joint fillers and sealers.

Install sample section of concrete sidewalk for review and approval by Architect. Mockup sample to include full construction features required by Drawings, including expansion joints and sealants, and control joints.

JOB CONDITIONS:

Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2: PRODUCTS

MATERIALS:

Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

Use flexible spring steel forms or laminated boards to form radius bends as required.

Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.

Concrete Materials: Comply with requirements of applicable Division - 3 Sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.

Welded Steel Wire Fabric: ASTM A185 Plain Type; in flat sheets; unfinished. Rolled WWF shall not be acceptable for use on this job.

Expansion Joint Materials: Bituminous Fiber, 1/2" thick, complying with NCDOT Spec. Section 928-1 and Section 420-12.

Liquid-Membrane Forming Curing Compound: Complying with ASTM C 309, Type I, Class A unless other type acceptable to Engineer. Moisture loss not more than 0.055 gr. / sq. cm. when applied at 200 sq. ft. / gal.

Detectable Tactile Warning Surfaces: Vitrified polymer composite panels, cast into concrete. Dark color. "Armor-Tile" as manufactured by Engineered Plastics or equivalent. Comply with all ADA and NC Accessibility code requirements.

CONCRETE MIX, DESIGN AND TESTING:

Comply with requirements of applicable Division - 3 Sections for concrete mix design, sampling and testing, and quality control, and as herein specified.

Design mix to produce normal-weight concrete consisting of portland cement, aggregate, water-reducing or high-range water-reducing admixture (super - plasticizer), air-entraining admixture and water to produce the following properties:

Compressive Strength: 3,000 psi, minimum at 28 days, unless otherwise indicated.

Slump Range: Not greater than 4".

Air Content: 5 % - 8%.

PART 3: EXECUTION

SUBSURFACE PREPARATION:

Remove loose material from compacted subbase surface immediately before placing aggregate base course. No aggregate base course shall be placed until the foundation has been inspected and approved by the Engineer. Proof-rolling may be required depending on condition of subbase.

Place aggregate base course material on prepared subgrade in layers of uniform thickness. Grade the base course evenly to thickness indicated on drawings and compact before placing concrete.

FORM CONSTRUCTION:

Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 2 hours after concrete placement.

Check completed formwork for grade and alignment to following tolerances:

Top of forms not more than 1 / 8" in 10'.

Vertical face on longitudinal axis, not more than 1/4" in 10'.

Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

REINFORCING

Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions, including load bearing pads.

CONCRETE PLACEMENT:

General: Comply with requirements of Division - 3 Sections for mixing and placing concrete, and as herein specified.

Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required 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.

Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent discoloration of reinforcing, dowels, and joint devices.

Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place a construction joint.

Drop top of curb as shown in details of plans at all radii of intersections, to allow construction of handicapped ramps and sidewalks.

Curbs and Gutters: Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades finish, and jointing as specified.

JOINTS:

General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.

Exterior Concreted Walks: Provide all concrete walk surfaces with a concrete walk 1/2" tooled expansion joints at 30' centers maximum and sawcut weakened-plane (contraction) joints at 5' centers maximum. Pour sample for Architect approval.

Weakened-Plane (Contraction) Joints: Provide sawcut weakened-plane (contraction) joints, sectioning concrete sidewalks at 5' intervals. Sawcut weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows:

Sawcut joints at concrete walks as soon as concrete has sufficient strength to prevent spalling of the joint due to the action of the saw. But in no case greater than 4 hours after initial placement of the concrete. Concrete walk sawcut joints shall not be filled with joint filler.

Tooled Joints: Form tooled joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer. Remove tooling marks.

Construction Joints: Place tooled construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2-hour, except where such placements terminate at expansion joints.

Construct joints as shown or, if not shown, use standard metal keyway-section forms.

Locate expansion joints at 90' o.c. for each curb and gutter section and 30' o.c. for each sidewalk section unless otherwise indicated, and at beginning and end of all curb and gutter radii. Connections with rigid objects including existing curb and gutter and catch basins.

Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.

Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or slip joint filler sections together.

Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

Fillers and Sealants: Comply with manufacturer's requirements for preparation of joints, materials installation, and performance. Place at all curb and gutter template joints, curb-to-walk transition joints, concrete walk expansion joints, tooled concrete walk construction joints. Joint filler not required at 5' O.C. sawcut weakened-plane contraction joints.

CONCRETE FINISHING:

After striking-off and consolidating concrete, smooth surface by screening and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

After floating, test surface for trueness with a 10' straight edge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

Provide all concrete walk surfaces with a unidirectional fine broom finish. Pour sample for Architect approval.

Broom Finish, by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Engineer.

Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honey combed areas. Remove and replace areas or sections with major defects, as directed by Engineer.

CURING:

Protect and cure finished concrete paving, complying with applicable requirements of Division - 3 Sections. Use membrane-forming curing and sealing compound or approved moist-curing methods.

REPAIRS AND PROTECTIONS:

Repair or replace broken or defective concrete, as directed by Engineer.

Drill test cores where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

Sweep concrete and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

The extent of work under this item includes the placement of aggregate base course and asphalt concrete pavement.

Asphalt concrete paving shall also mean asphalt paving, or bituminous concrete as may be used in other sections of the specifications or drawings.

Related Work Specified elsewhere:

Section 01060 Geotechnical Subsurface Report

SUBMITTALS:

Material Certificates: Asphalt Concrete Paving:

Provide two copies of materials certificates signed by the material producer and the Contractor, and notarized, certifying that each material item complies with, or exceeds, specified requirements.

Job Mix Formula: Provide two copies of the proposed job mix formula at least 10 days prior to beginning work. This formula shall be approved by NCDOT for the type of pavement specified. Contractor shall, at his own expense, take whatever measures are necessary in order to obtain said approval prior to beginning work or have a mix design prepared by an approved Testing Lab.

SITE CONDITIONS:

Weather Limitations: Construction shall be conducted in accordance with the weather limitations given in the applicable sections of "Standard Specifications for Roads and Structures" as issued by N. C. Department of Transportation. No asphalt concrete shall be placed when the ambient temperature is less than 40 degrees F (4°C.) in the shade away from artificial heat.

Grade Control: Establish and maintain required lines and elevations as necessary to match existing grades and / or proposed grades on the drawings.

LIQUID ASPHALT PRICE ADJUSTMENT:

Asphalt shall be bid based on the FOB binder price in effect on Bid Date, per ton. Adjustments to the contract will be made + / - in accordance with NCDOT Section 620-5 "Basis of Payment" rules.

PART 2: PRODUCTS

MATERIALS:

General: Use locally available materials and gradations, which exhibit a satisfactory record of previous installations.

Aggregate Base Course: Aggregate meeting the requirements of Section 910-1, Paragraph (a) of "Standard Specifications for Roads and Structures" by NCDOT.

Asphalt Concrete Base Course Type B 25.0 B: Materials meeting the requirements of Section 645 of "Standard Specifications for Road and Structures" as issued by NCDOT.

Asphalt Concrete Intermediate or Base Course Type I 19.0. B: Materials meeting the requirements of Section 645 of "Standard Specifications for Road and Structures" as issued by NCDOT.

Asphalt Surface Course, Type S-9.5 A: Materials meeting the requirements of Section 645-2 and 3 of "Standard Specifications for Road and Structures" by NCDOT.

Tack Coat: Material meeting the requirements of Section 605-2 of "Standard Specifications for Roads and Structures" as issued by NCDOT. Only on existing asphalt to be overlaid.

Striping: Glidden "Romark" traffic marking paint, or approved equivalent. Apply full 2-coat thickness for all striping and graphics, and symbols. Provide manufacturer's recommended wet and dry film thickness per coat. Allow manufacturer's specified cure time between coats.

All markings in NCDOT right-of-ways to be thermoplastic as approved by NCDOT.

Asphalt Seal Coat: Mineral reinforced asphalt emulsion blended with polymers, 58% to 63% solids, equivalent to Polymer Modified MasterSeal. Apply per manufacturer's instructions and specifications and in compliance with ASMA Standard Specifications.

PART 3: EXECUTION

GENERAL:

Install the aggregate base course, asphalt surface course, prime coat and tack coat in accordance with the applicable provisions of "Standards Specifications for Roads and Structures" as issued by the North Carolina Department of Transportation.

Provide milling and/or wedging of existing asphalt surfaces at asphalt paving modifications and tie-ins as necessary to meet indicated grades of modified areas.

SUBGRADE:

Shape surface of areas under base course to line, grade and cross-section shown on drawings, with finish surface not more than 1/2" above or below the required subgrade elevation.

Patches in driveways and roadways shall be graded to depth required to match existing pavement or to provide minimum pavement specified.

Maintain a uniform surface on the subgrade until the placement of aggregate base course is complete.

Provide a proof rolling of the compacted subgrade with a heavy roller or loaded dump truck (+25 tons) in the presence of the Engineer. The proof rolling shall be covered by the wheels of the proof roller operating at a speed between 2 and 3 miles per hour.

Any areas that rut or pump excessively shall be allowed to dry or shall be undercut and backfilled with select backfill or coarse aggregate base course as directed by the Engineer.

After undercut and backfill operations are complete, a final proof rolling of the undercut areas will be performed in the presence of the Engineer.

AGGREGATE BASE COURSE:

Place base course material on prepared subgrade in layers of uniform thickness. Subgrade shall be inspected and accepted for placement of base coarse by Engineer as described above. Grade the base course evenly and compact to 100%. The thicknesses indicated on drawings are compacted thickness.

Maintain a uniform surface on the base course until the placement of the asphalt surface course is complete.

Provide a proof rolling of the compacted aggregate base course with a heavy roller or loaded dump truck (+25 tons) in the presence of the Engineer. The proof rolling shall be covered by the wheels of the proof roller operating at a speed between 2 and 3 miles per hour.

Any areas that rut or pump excessively shall be allowed to dry or shall be undercut and subgrade replaced with select backfill or coarse aggregate base course as directed by the Engineer.

After undercut and backfill operations are complete, a final proof rolling of the undercut areas will be performed in the presence of the Engineer, and Owners representative.

TACK COAT:

Tack Coat shall be applied to contact surfaces of previously constructed asphalt or portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement. All application of tack coat shall be in conformance with Section 605 of the N. C. Highway Specifications for Roads and Structures latest revision.

Tack coat shall be uniformly applied at a rate of 0.02 to 0.05 gallons per square yard. No more tack coat material shall be applied than can be covered with base, binder, or surface course during the following day's operations. No base, binder or surface mixture shall be deposited thereon until the tack coat has sufficiently cured to properly receive paving.

All exposed surfaces, not intended to contact paving, shall be protected sufficiently to prevent tack coat from being tracked or splattered on said surfaces. After the tack coat has been applied, it shall be protected until it has cured for a sufficient length of time to prevent it from being picked up by traffic.

PLACING ASPHALT CONCRETE PAVEMENT:

Place asphalt concrete pavement in as continuous as operation as possible. The Contractor shall spread the materials to uniform density and strike a smooth finish true to cross-section and free from inequalities. Spread mixture at minimum temperature of 225 degrees F. Place each course in the required amounts, so that when compacted, they will conform to the indicated grade, cross section, and thickness. All seams or joints are to be raked smooth prior to rolling.

Provide joints between old and new pavements and between successive days' work for continuous bond between adjoining work. Clean contact surfaces and apply tack coat.

Rolling: Begin rolling when asphalt concrete mixture will bear roller weight without excessive displacement. Repair surface defects with hot asphalt concrete material as rolling progresses. Cut out and patch defective areas and roll to blend with adjacent satisfactory paving. Continue rolling until maximum density is attained and roller marks eliminated.

Protect paving from damage and vehicular traffic until asphalt concrete mixture has cooled and attained its maximum degree of hardness.

FIELD QUALITY CONTROL:

GENERAL:

Test the in-place asphalt concrete courses for compliance with requirements for thickness, compacted density and surface smoothness. Repair or remove and replace unacceptable paving as directed by the Engineer, or Owner.

Thickness: In-place thickness will not be acceptable if exceeding following allowable variation from required thickness:

Course Aggregate Base Course: 1/2", plus or minus.

Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 10' straight edge applied parallel with, and at right angles to center line of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness:

- Wearing Course Surface: 1/8"
- Check surfaced areas at intervals as directed by the Engineer.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1 - GENERAL

- 1.1 All materials and installation methods shall be in accordance with these plans and specifications and applicable AWWA Standards and the AUTHORITY HAVING JURISDICTION (AHJ) standards and specifications. The Contractor shall obtain from the Owner certificate of approval for the substitution of any material other than those specified. Excavation & backfilling shall conform to TRENCHING AND BACKFILLING FOR UTILITIES.
- 1.2 Current specifications of the American Society for Testing Materials (ASTM) and the American National Standards Institute (ANSI) shall apply in all cases where material is covered by an item in these specifications, and all material used under this contract shall conform fully to these current specifications or be removed from the job at the direction of the Owner. Failure of the Owner to condemn material on preliminary inspection shall not be grounds for acceptance if future defects are found.
- 1.3 Detail or shop drawings of valves and tapping sleeves must be approved by the Engineer prior to installation, or approval of payment for same.
- 1.4 It shall be the contractor's responsibility to notify the Owner and the AHJ at least 24 hours in advance of beginning any construction work on any portion of this project.
- 1.5 Preconstruction Conference: Prior to commencing any water extension construction work, the Department Engineer shall be contacted to schedule a preconstruction conference. No construction shall occur until after the preconstruction conference is held.
- 1.6 Contractor shall be responsible for verifying all elevations, dimensions, locations and sizes of existing facilities in the field prior to construction or ordering materials.
- 1.7 Pipe installation shall be performed only in the presence of the AHJ's Representative, except as authorized by the AHJ.
- 1.8 Backfilling shall be performed only with the approval of a AHJ's Representative.
- 1.9 The Contractor shall construct and maintain all detours, crossings and temporary approaches that may be required during construction. Maintenance shall be in accordance with the applicable features of Section 150 of the N.C. Department of Transportation Standard Specifications.
- 1.10 All PVC water main shall be installed with Detectable marking tape shall be installed in accordance with Section 3. Tape shall be three (3) inches in width with a minimum thickness of 0.5 millimeters (minimum solid center foil thickness of 0.35 millimeters). Color of the tape shall be blue meeting the American Water Works Association color code. Tape shall read: "Caution – Buried Water Line Below". Tape shall be manufactured by Lineguard, Inc., Pro-Line Safety Products Co., Empire Level Mfg. Corp., or approved equal.

1.11 Property Protection:

- 1.11.1 Trees, fences, poles and all other property shall be protected unless their removal is authorized, and any property not authorized for removal, but damaged by the Contractor shall be restored by the Contractor to the Owner's satisfaction.
- 1.11.2 Signs, mailboxes and other items which must be removed to facilitate construction shall be replaced in a condition equal or better than condition prior to removal. Replacement shall occur immediately following backfill of the trench at the location of each item removed.
- 1.11.3 All existing drainage shall be maintained at all times on the Project. Any drainage swales, ditches, culverts, etc. blocked by construction activities shall be reopened at the end of the day before leaving the job site.

1.12 Encroachment Contracts and Permits:

- 1.12.1 Prior to actual construction, the Owner shall acquire the necessary encroachments from NCDOT for installations. When working inside the rights-of-way of State system roads for highways, the Contractor shall acquire the necessary permits for his work.
- 1.12.2 The Contractor shall be responsible for securing all other local and state permits required for the utility construction.
- 1.12.3 Open cut shall be used for excavation of all water mains unless written permission of the Owner is given, or as specified by the encroachment agreement with the N.C. Department of Transportation.

1.13 Record Drawing: An updated record drawing shall be prepared by the contractor and submitted to the Engineer as a condition of approval for any pay request which includes pay items for water and/or sewer improvements. Record drawings shall be prepared by and bear the seal and signature of a Professional Engineer or Registered Land Surveyor.1.14 Guarantee: The Contractor shall guarantee all material, equipment, and workmanship for a period of one year after final acceptance by the Owner and the AHJ. Inspection may be made by AHJ within the one-year warranty. The Contractor shall make any and all necessary repairs to the system within this his one-year warranty period at no additional cost to the Owner or the AHJ.

Before the guarantee period shall begin, the record drawings and other relevant information shall be approved and the owner shall receive a letter of acceptance from the AHJ for the water.

PART 2 - MATERIALS

- 2.1 PVC Water Mains - 4" through 12": All mains 4" through 12" shall be polyvinyl chloride pipe meeting the requirements of the latest edition of AWWA C-900. The pipe shall be rated at 150 psi, and SDR 18 with integral bell and spigot joints. Outside diameter of the pipe shall be the same as cast iron. Joints shall be elastomeric-gasket type designed to accommodate up to 3 degrees of axial deflection without adverse consequences. Pipe shall be furnished in nominal 20 foot lengths
- 2.2 PVC Water Mains to 3": All water mains to 3" PVC water main shall be Class 200 SDR 21 conforming to ASTM D1784 and ASTM D2241 with "push-on" joints. Fittings shall be Schedule 80 PVC with solvent weld joints. Pipe shall be furnished in nominal twenty-foot (20') lengths. All pipe shall bear the NSF logo.
- 2.3 Ductile Iron Pipe: Ductile iron pipe for water mains shall be manufactured in conformance with AWWA C151 and shall be cement mortar lined with an asphaltic coating in accordance with AWWA C104. The exterior of the pipe shall be bituminous coated in accordance with AWWA C151. The minimum thickness Class of pipe shall be Class 50. Pipe shall be furnished in nominal 18 to 20 foot lengths. Pipe joints for ductile iron pipe shall be "push-on" unless the additional pipe deflection allowed by mechanical joints is necessary or other considerations dictate the use of mechanical joints. The joints for ductile iron pipe shall conform to AWWA Standard C111 revision (ANSI A21.11).
- Polyethylene encasement shall be applied to all underground ductile iron pipe and fitting installations. Material and installation procedures shall be in accordance with ANSI/AWWA C105/A21.5-88.
- 2.4 Gate Valves: Gate Valves shall conform to requirements of the latest version of AWWA Specification C-509 for resilient seated gate valves. The valve body shall be ASTM A-126 Class B cast iron. All interior valve parts and surfaces shall be of corrosion resistant materials or have an epoxy coating sufficient to prevent corrosion. Such coating shall be recognized by the AWWA for potable water use. Exterior valve parts and surfaces shall be epoxy coated or have the Standard AWWA coating. The valves shall open counterclockwise and have non-rising stem operation with 2-inch square operating nuts. The maximum number of turns required to fully open or close the valve shall equal three times the pipe diameter plus two. The stem shall be of corrosion resistant material and have "O" ring seals. Valve shall provide zero leakage at a working pressure of 200 psi in either direction of line flow. Valves shall have flange connections conforming to ANSI B16.1. Class 125 or mechanical joints conforming to AWWA C-111. Valves shall be manufactured by Clow, American Flow Control, or Mueller.
- 2.5 Ball Valves (2"): Ball valves for two-inch mains and services shall be bronze body with tee head. The turn required to travel from fully closed to fully open position shall be 90 degrees. Ball valves shall be Hayes 4300, A.Y. McDonald 6101W, Ford B11-777, Mueller B-20283or approved equal.

2.6 Valve Boxes

Valves 2" through 10" - Valve boxes shall be of cast iron suitable for H-20 loading. The manufacturer's name and part number shall be cast into each component of the box. The

box shall be of the telescoping (slip) type consisting of a base section, center extensions as necessary, and a top section with a cover marked "WATER". Sections shall be selected and installed such that a minimum of four inches (4") of future adjustment (upward and downward) is possible without section removal or replacement and without the use of adapters. Valve boxes and extensions shall be either of the following:

- Charlotte Pipe and Foundry: UTL-274 (valve boxes) and UTL-281 (extensions).
- Tyler Pipe: 6855 Series (valve boxes and extensions). Lid shall be 5-1/4" Drop Lid having a minimum of 1-1/2" deep skirt.
- East Jordan Iron Works Global Cast: G-8472 Slip-Type Valve Box Series

Valve boxes shall be installed in accordance with the Standard Details.

- 2.6.1 Valves 12" and Larger – Valve box shall consist of an East Jordan Iron Works – 157801 frame and cover with a valve box bottom and extensions, as needed in accordance with Section 7.3.4.1. Installation shall be in accordance with the Standard Details.

- 2.7 Fittings: Tees, elbows and other fittings for PVC SDR 21, PVC C-900 pipe and ductile iron pipe shall be of ductile iron. Standard dimension fittings or compact fittings may be used in accordance with the requirements of this Section. The interior of all fittings shall be cement mortar lined with an asphaltic coating in accordance with AWWA Standard C-104 (ANSI 21.4). The exterior of all fittings shall have a one (1) mil bituminous coating in accordance with AWWA Standards C-110 (ANSI A21.10).

Compact fittings shall be ductile iron with either push-on or mechanical joints in accordance with ANSI/AWWA C153/A21.53-84. Cement lining and asphaltic coating shall be provided in accordance with ANSI/AWWA C104/A21.4.

Standard dimension fittings for PVC SDR 21, PVC C-900 pipe and ductile iron pipe shall be of ductile iron with either "push-on" joints or mechanical joints. The fittings shall comply with all requirements of AWWA Standard C-110 (ANSI A21.10). Shall be designed for a minimum working pressure of 150 psi plus 100-psi surge pressure.

2.8 Restraint Devices

- 2.8.1 Restraint devices for use on PVC SDR 21, ductile iron and C-900 PVC "push-on" joints shall be constructed of high strength ductile iron, ASTM A536, Grade 65-45-12 and shall incorporate machined serrations on the inside diameter to provide positive restraint, exact fit, full circle contact and support of the pipe in an even and uniform manner. Bolts and connecting hardware shall be of high strength, low alloy material in accordance with ANSI/AWWA C111/A21.11, latest revision thereof. All devices shall have a safety factor of no less than 2:1 at the full rated pressure of the pipe on which it is installed. They shall be UL listed and Factory Mutual approved. Restraining devices shall be Uni-Flange Block Buster Series 1390-C, Star Pipe Products Allgrip series 3600 and Pipe Restrainers Series 1200S, or approved equal.

- 2.8.2 Restraint devices for use on mechanical joint to PVC SDR 21 and C-900 PVC, shall be constructed of high strength ductile iron, conforming to the requirements of ASTM A536, Grade 65-45-12, and shall incorporate machined serrations on the inside diameter to provide positive restraint, exact fit, full circle contact and support of the pipe in an even and uniform manner. Bolts and connecting hardware shall be of high strength low alloy material in accordance with ANSI/AWWA C111/A21.11, latest revision thereof. All devices shall have a safety factor of no less than 2:1 at the full rated pressure of the pipe on which it is installed. They shall be UL listed and Factory Mutual approved. Restraining devices shall be Uni-Flange Series 1500, Star Pipe Products, Allgrip Series 3600, Romac Industries, Inc GripRing or approved equal.
- 2.8.3 Restraint devices for use on mechanical joint ductile iron, shall be constructed of high strength ductile iron, conforming to the requirements of ASTM A536, Grade 65-45-12, and shall incorporate machined serrations on the inside diameter to provide positive restraint, exact fit, full circle contact and support of the pipe in an even and uniform manner. Bolts and connecting hardware shall be of high strength low alloy material in accordance with ANSI/AWWA C111/A21.11, latest revision thereof. All devices shall have a safety factor of no less than 2:1 at the full rated pressure of the pipe on which it is installed. They shall be UL listed and Factory Mutual approved. Restraining devices shall be Uni-Flange Series 1300-C, Star Pipe Products, Allgrip Series 3600, Romac Industries, Inc. GripRing or approved equal.
- 2.8.4 Locked hydrant tees and fittings for fire hydrants shall meet the requirements of AWWA Standard C-111 (ANSI A21-11). Locked tees shall be as manufactured by American Cast Iron Pipe Company, Clow, U.S. Pipe, or approved equal.
- 2.8.5 Bolted Couplings for PVC SDR 21 and PVC C-900 pipe and ductile iron pipe shall be constructed of a center sleeve and end rings of ductile iron in accordance with ASTM A536. Bolts and nuts shall be of high strength, low alloy steel per ASTM A242 and AWWA C-111. Center sleeve and end rings shall have a paint finish coat. Couplings shall be Ford Style FC1, Romac 501 Series, Smith Blair 441, or JCM 201.
- 2.9 Fire Hydrants: Hydrants shall be in accordance with AWWA Standard C502, latest revision thereof, suitable for an operating pressure of not less than 150 pounds per square inch and shall have a traffic breakable feature (safety flange and stem coupling), dry top, sealed lubrication reservoir and a main valve which is held closed with pressure. The hydrant body shall be cast iron with "O" ring seals and bronze threads on the seat ring and drain ring, and shall have two (2) 2 1/2-inch nozzles with caps having National Standard threads and one (1) 5-inch nozzle with a factory fitted Storz connection and cap. The hydrant main valve shall be a minimum of 5-1/4 inches in diameter. All continuously wetted hydrant parts and surfaces shall be of corrosion resistant materials or be epoxy coated with epoxy recognized by AWWA for potable water use. The epoxy coating shall be of a color other than black (unless the word "epoxy" is stenciled on the base) to permit distinction between standard and epoxy coatings to be made easily. Hydrants shall be American Darling B-84-B, Mueller A-423 or Clow Medalion.

The inlet shoe for fire hydrant shall have a six-inch (6") inside diameter and shall be cast or ductile iron with mechanical joint fittings in accordance with AWWA Standard C110.

- 2.10 Tapping Sleeves - Tapping sleeves shall be all stainless steel body and flange with a full circumferential gasket, or ductile iron body, mechanical joint designed to accommodate a minimum operating pressure of 150 pounds per square inch. All tapping sleeves shall be pressure tested prior to tapping the main. Stainless steel tapping sleeves shall be Ford Model FAST, JCM Model 432, Mueller Model H304 or Romac Model SST. Ductile iron body, mechanical joint sleeves shall meet the requirements of Section 7.2.3 of this Manual.
- 2.11 Tapping Valves - Tapping valves shall conform to the requirements of the latest revision of AWWA Specification C-509 for resilient- seated gate valves. The valve body shall be ASTM A-126 Class B cast iron. All internal valve parts and surfaces shall be of corrosion resistant materials or have an epoxy coating sufficient to prevent corrosion. Such coating shall be recognized by the AWWA for potable water use. Exterior valve parts and surfaces shall be epoxy coated or have the Standard AWWA coating. The valves shall open counterclockwise and have non-rising stem operation with a two-inch square operating nut. The maximum number of turns required to fully open or close the valve shall equal three times the pipe diameter plus two.

The stem shall be of corrosion resistant material and have O-ring seals. Valves shall provide zero leakage at a working pressure of 200 psi in either direction of line flow. Valves shall have a flange connection conforming to ANSI B16.1 Class 125 and a mechanical joint conforming to AWWA C-111. Valves shall be manufactured by Mueller, Clow or American Flow Control. Tapping valves shall be installed and pressure tested prior to tapping the water line.

- 2.12 Steel Encasement Pipe: Steel encasement pipe shall be spiral welded or smooth wall seamless, consisting of grade "B" steel with a minimum yield strength of 35,000 psi and manufactured in accordance with ASTM A139 and A283. The pipe thickness shall be in accordance with the requirements of the right-of-way owner, but in no case less than that shown in the following table. The ends shall be beveled and prepared for field welding at the circumferential joints.

MINIMUM WALL THICKNESS FOR STEEL ENCASEMENT PIPE

<u>NOMINAL DIAMETER IN INCHES</u>	<u>MINIMUM THICKNESS IN INCHES</u>
4- 12 3/4	0.188
14	0.219
16-18	0.250
20	0.281
22	0.312
24	0.344
26	0.375
28-30	0.406
32	0.438
34-36	0.469
38-42	0.500

The encasement pipe shall be uncoated inside and out unless required otherwise by the right-of-way owner or the AHJ.

Encasement pipe and joints shall be of leak proof construction, capable of withstanding design loading. The inside diameter of the encasement pipe shall be at least 2 inches greater than the largest outside diameter of the carrier pipe, joints or couplings, for carrier pipe less than 6 inches in diameter; and at least 4 inches greater for carrier pipe 6 inches and larger in diameter. It shall, in all cases, be great enough to allow the carrier pipe to be removed subsequently without disturbing the casing pipe or roadbed. Engineer to verify clearance between carrier pipe and encasement pipe.

- 2.11 Backflow Prevention: Control assemblies such as reduced pressure principal assemblies, double check valve assemblies and double detector check valve assemblies shall be limited to those approved by the Bertie Co. Regional Water System and the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California. RPZ or RPDA shall be Watts 909, Wilkins 375, or Febco 860 or approved equal.

PART 3 - CONSTRUCTION METHODS

- 3.1 GENERAL: Installation of the water main shall be in conformance with the latest AWWA Standards and the specific recommendations of the pipe manufacturer. Before any installation is begun, the contractor shall notify NC One Call, at least 48 hours prior to commencing construction in order that existing utilities in the area may be flagged or staked. The contractor shall be responsible for damage to any existing overhead and underground utility systems.

3.2 HANDLING AND STORING MATERIALS:

- 3.2.1 The Contractor shall be responsible for the shipping and storing of all water main materials. Any material which is damaged or defective shall be replaced by the Contractor at his own expense.
- 3.2.2 The loading and unloading of all pipe, valves, hydrants, manholes and other accessories shall be in accordance with the manufacturer's recommended practices and shall at all times be performed with care to avoid any damage to the material.

The Contractor shall locate and provide the necessary storage areas for materials and equipment. If private property is being used for storage areas, Contractor must have the written consent from the property owner.

- 3.2.3 All materials once on the job site shall be stored in accordance with the manufacturer's recommendations. All PVC water pipe shall be protected from the sun's ultra violet rays if stored on the job site longer than 20 days. The type of protective cover for all plastic pipe material shall be approved by the Owner prior to use.
- 3.2.4 All valves and hydrants shall be stored so that they are protected from freezing. All pipe shall be kept free of dirt and other debris. Any damage relating to the coating of the various materials for water mains shall be repaired in a manner approved by the Owner.
- 3.2.5 The Contractor shall be responsible for safeguarding and protecting all material and equipment stored on the job site. The Contractor shall be responsible for the storage of

materials in a safe and workmanlike manner to prevent injuries, during and after working hours, until project completion.

3.3 PIPE INSTALLATION:

- 3.3.1 Trenching and Backfilling: shall conform to "Technical Specifications for Trenching and Backfilling of Utilities". Trenches shall be free of water during pipe installation. Trench excavation shall require the provisions of vertical curve chords which will not exceed the permissible deflection of the pipe. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each joint of pipe on undisturbed soil at every point along its entire length. The placement of No. 57 crushed stone shall be placed in the bottom of the trenches when unstable material is encountered. Such unstable material shall be removed to the depth required by the AHJ and replaced with No. 57 stone such that the pipe will be adequately supported throughout its entire length. Excavation below the planned pipe invert elevation shall be refilled with No. 57 crushed stone.
- 3.3.2 PVC and ductile iron pipe shall be installed in accordance with the procedures of AWWA C900 and C600 respectively and with the manufacturer's recommendations. Minimum cover over top of the pipe shall be 36".
- 3.3.3 Pipe fittings shall be installed as shown on the drawings or where necessary so as to not exceed the allowable joint deflection of AWWA C600. All fittings shall be measured and referenced on the Contractor's record drawings.
- 3.3.4 All PVC water main shall be installed with three inch (3") wide metallic detectable tape. The tape shall be clearly marked "Water" and shall be centered over the main, installed twelve inches (12") below finished grade. Any breaks in the tape shall be repaired in accordance with the manufacturer's recommendations.
- 3.3.5 1" Service Tubing: shall be installed with sufficient slack to prevent tension on the line. A maximum of three splices (couplings) per service shall be allowed. Tubing shall have a minimum cover of twenty-four inches (24"). See the standard details. If the service tubing is damaged during construction such that its flow capacity or its life expectancy is adversely affected, the damaged portion shall be replaced. It shall be installed with a minimum of six inches (6") of vertical separation from an existing or proposed storm drain.
- 3.3.6 1 1/2" and 2" services: shall be installed in accordance with the Standard Details. The installation of the Class 200 PVC service pipe shall be in strict conformance with the requirements for mains, except that the service pipe shall have a minimum cover of 24".
- 3.4 CUTTING OF PIPE: Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Owner's Representative, cutting shall be done with a suitable mechanical cutter.

3.5 ADJACENT FACILITIES:

- 3.5.1 Sewer Lines: Where the location of the water pipe is not clearly defined in dimensions on the drawings, the water pipe shall not be laid closer horizontally than 10 feet from a

sewer except where the bottom of the water pipe will be at least 18 inches above the top of the sewer pipe. Where water lines are less than 18 inches above the sewer lines, or cross under sewer lines, the water and sewer pipe for a distance of at least 10 feet each side of the crossing shall be made of ductile iron pressure pipe. The section of water main pipe shall be centered at the crossing

- 3.5.2 Water lines shall not be laid in the same trench with sewer lines, gas lines, or electric wiring.

- 3.6 JOINT DEFLECTION: Deflection will be in accordance with the pipe manufacturers recommendations.

3.7 JOINTING

- 3.7.1 PVC and Ductile Iron Pipe: Push-on type joints shall be installed in accordance with pipe manufacturer's recommendations.

- 3.7.2 Connections between different types of pipe and accessories shall be made with transition fittings approved by the Owner's representative and the AHJ.

- 3.8 SERVICE LATERALS: Service Laterals shall conform to the standard details. Meter will be provided by the Owner/Contractor unless otherwise negotiated with the Bertie Co. Regional Water System.

3.9 SETTING OF FIRE HYDRANTS, VALVES, VALVE BOXES AND METER BOXES:

- 3.9.1 Fire Hydrants shall be located and installed as shown on the drawings and details. Each hydrant shall be connected to the main with a 6-inch branch line having at least three feet of cover. Hydrants shall be set plumb with pumper nozzle facing the roadway and with the center of lowest outlet not less than 18 inches above the finished surrounding grade, and not more than 24 inches above the finished surrounding grade. The hydrant shall be set in a bed of washed rock which shall surround the barrel at least 12 inches in all directions.

- 3.9.2 Valves and Valve Boxes shall be installed where shown or specified, and shall be set plumb. Valve boxes shall be centered on valve. Where feasible, valves shall be located outside the area of roads and streets. Earth fill shall be carefully tamped around each valve box to a distance of 4 feet on all sides of the box, or to the undisturbed trench face if less than 4 feet. Valve boxes outside of pavement shall have a concrete block 2 feet square by 6 inches thick poured around it, or precast concrete collar set flush with the existing grade.

- 3.9.3 Hydrants and Valves after delivery shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. The hydrant or valve shall be fully opened and fully closed to insure that all parts are in working condition.

- 3.9.4 Meter boxes and brick for one-inch (1") services shall be provided by the Contractor as shown on the Standard Details. Meter boxes installed for multi-family developments and ganged together shall be marked with the unit number being served. Markings shall be permanently painted on the inside of the frame section and highly visible and shall be in sequential order.

- 3.10 JOINT RESTRAINT: Plugs, caps tees and bends either vertically or horizontally, on all water lines and fire hydrants shall be provided with joint restraint. Joint restraint will be provided by concrete thrust blocks. In lieu of concrete thrust blocking, piping systems 12 inches and smaller in diameter may be restrained through the use of restrained joint pipe or approved joint restraint devices meeting the material specifications in section 2. The minimum length of piping to be restrained shall be as set forth in the table below.

*Restrained Length (ft.)					
Pipe Size (in.)	4	6	8	10	12
Pipe Cover (ft.)					
3.0	16	24	31	38	46
4.0	15	23	30	37	43
5.0	14	22	29	36	42

* Above values are the lengths of restrained pipe required on each side of fitting. Above values are for 45 horizontal bend. For other horizontal bends multiply above by the following coefficients: 90 - 2.4; 22 1/2 - 0.48; 11 1/4 - 0.24; dead end - 2.4.

The use of joint restraint devices on vertical bends and on piping systems larger than 12 inches in diameter shall not be utilized unless approved by the Bertie Co. Regional Water System.

The use of combined thrust restraint systems employing concrete blocking and joint restraint devices, based on each system being designed to resist a percentage of the resultant thrust force, shall not be permitted. The use of combined systems based on each system being designed to resist all of the resultant thrust force are permitted

- 3.10.1 Concrete Thrust Blocking: Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair.

- 3.11 All boring and jacking installations shall be accomplished with the use of encasement pipe which as a minimum meets the specifications set forth in Section 7.9 of the Manual. The carrier pipe shall be DIP with "push-on" joints in conformance with the requirements of Section 7.2 of this Manual. The ends of the encasement pipe shall be as shown in the Standard Details.

3.12 TESTING OF WATER SYSTEM EXTENSIONS

- 3.12.1 Test Sequence: The following test sequence shall be used unless otherwise approved by the AHJ.
- Perform pretest inspection.
 - Clean the main.
 - Perform the hydrostatic tests.
 - Apply the proper dosage of chlorine.
 - Allow chlorine solution to remain in the water main a minimum of 24 hours.
 - Assist the AHJ in taking bacteriological samples.

- 3.12.2 Pretest Inspection: Prior to commencement of hydrostatic testing and chlorination, the AHJ shall be contacted to request scheduling of inspection and testing. A AHJ's Representative shall visually inspect the installation prior to testing to insure that all fire hydrants, valves and other appurtenances are properly located, operable, and installed at the proper grade. All defects disclosed by the inspection shall be corrected prior to testing.
- 3.12.3 Cost of Tests: The cost of testing the mains, including all temporary connections, shall be included in the unit price bid for pipe.

3.13 HYDROSTATIC TESTS

- 3.13.1 General: Where any section of a water line is provided with concrete thrust blocking for fittings, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking unless otherwise approved. The method proposed for disposal of wastewater from hydrostatic tests and disinfection shall be submitted to the Owner's Representative prior to performing hydrostatic tests.
- 3.13.2 Tests: Unless otherwise permitted, pressure and leakage testing shall be performed between each main line valve in accordance with AWWA C600. The AHJ will, except when certain circumstances dictate otherwise, permit the lengths of test sections to be a maximum of 1500 feet in subdivisions or other areas where the new main has closely spaced valves. Testing shall be done only in the presence of a AHJ's Representative. Testing shall be performed using a suitable pump and an accurate gauge graduated in 1.0 psi increments. The section of the main to be tested shall be subjected to a test pressure of 150 psi for a period of two (2) hours. The leakage of the test section shall be accurately determined and compared to the schedule shown below. All visible leaks shall be repaired regardless of the amount of leakage.

ALLOWABLE LEAKAGE	
PIPE SIZE (inches)	(Gallons per hour per 1000 feet of pipe)
2	0.16
4	0.33
6	0.50
8	0.66
10	0.83
12	0.99
14	1.29
16	1.47
18	1.66
20	1.84
24	2.21
30	2.76
36	3.31

If the leakage is greater than the allowable leakage as given by the above table, the Contractor shall replace any defective materials and perform all necessary work to insure that the installation is acceptable and a retest shall be performed subsequent to any repair work performed. Remedial repair work and retesting shall be repeated until

the leakage occurring during the test period is less than or equal to the allowable leakage.

3.14 CHLORINATION

3.14.1 All water supply mains shall be disinfected by the Contractor. No extra payment will be provided as this work is considered to be an element of other work units. The disinfection process shall be in conformance with the standards of the N.C. Division of Health Services.

3.14.2 Chlorination shall be performed only in the presence of a AHJ's Representative and shall be performed only after the line is complete and has tested satisfactorily for leakage.

3.14.3 Pipe subjected to contaminating materials shall be treated as directed by the AHJ or Engineer; should such treatment fail to cleanse the pipe, replacement shall be required. The Owner shall bear no portion of any cost sustained by Contractor in meeting this specification.

3.14.4 Chlorination of a completed line shall be carried out after completing the pressure test and in the following manner.

3.14.4.1 Chlorination taps will be made within five (5) pipe diameters of the water main control valve at the upstream end of the line and at all extremities of the line.

3.14.4.2 A solution of water containing high test hypochlorite (70%) available chlorine or chlorine gas solution shall be introduced into the line by regulated pumping at the control-valve tap. The solution shall be of such a concentration that the line shall have a uniform concentration of 50 ppm total chlorine immediately after chlorination. The chart below shows the required quantity of 70% HTH compound to be contained in solution in each 1000 foot section of line to produce the desired concentration of 50 ppm. The chlorination solution shall be introduced to the main at a constant rate while regulating the flow of water through the main being chlorinated such that the required concentration of chlorine is achieved throughout

Pipe Size	Pounds High Test Hypochlorite (70%) Per 1000 Feet of Line
6"	1.76
8"	3.12
10"	4.84
12"	7.00
14"	9.52

3.14.4.3 The HTH solution shall be circulated in the main by opening the control valve and systematically manipulating hydrants and taps at the line extremities. The HTH solution must be pumped in at a constant rate for each discharge rate in order that a uniform concentration will be produced in the mains. All valves within the section of main being chlorinated shall be operated once during the contact period.

3.14.4.4 Services shall be chlorinated at the same time and by the same method utilized

for the main.

3.14.4.5 The chlorine solution shall remain in lines for no less than 24 hours, unless otherwise directed by the AHJ.

3.14.4.6 Extreme care shall be taken to prevent contamination of existing water mains during the test period. If, in the opinion of the AHJ, an existing main is contaminated, the section of main subjected to the possible contamination shall be flushed and chlorinated in accordance with the requirements for new mains. The Owner shall bear no portion of any cost sustained by Contractor in meeting this specification.

3.14.4.7 The AHJ will advise the Contractor when a suitable period of time has elapsed for chlorine contact. The main shall be flushed thereafter in the presence and under the direction of the AHJ's Representative. The flushing of the main shall be considered complete when the chlorine concentration with the main is less than or equal to the lesser of the following values:

3.14.4.7.1 One (1) part per million (ppm) free chlorine.

3.14.4.7.2 The free chlorine concentration within the existing main to which the extension has been connected.

3.14.5 The Contractor shall be responsible for insuring that high-strength chlorine solution is contained on-site and not allowed to make its way to any watercourse, stream, creek, lake, or other body of water.

3.15 BACTERIOLOGICAL TESTING

3.15.1 After completion of chlorination and flushing, the Contractor shall assist the AHJ as necessary in obtaining sufficient bacteriological samples for complete testing. Bacteria samples must be tested by a State-approved laboratory. A list of approved laboratories is located on the Public Water Supply website at: http://www.ncwater.org/pws/Compliance/electronic_reporting.html.

3.15.1 The AHJ shall determine the location of samples and the number of samples necessary to provide a test group which is representative of the section of main being tested.

3.15.2 A failure of any sample of a test group shall constitute failure of the entire test group from which the sample was taken. Such failure shall require two (2) successive passing test groups to substantiate that the main has been satisfactorily chlorinated. The Contractor, may at his option, rechlorinate and retest the section of water main upon failure of the test group.

3.15.3 If two (2) successive bacteriological test groups fail, the section of main from which the group is taken shall be rechlorinated and retested until the main is shown to be properly chlorinated in accordance with Paragraph 3.14.

3.16 Cleaning of the Main

3.16.1 General: Mains shall be cleaned only in the presence of a AHJ representative. No valves or hydrants owned by the AHJ shall be operated without the express permission of the AHJ.

- 3.16.2 Cleaning of Water Mains Smaller Than 4" in Diameter: Mains shall be cleaned by flushing. Flushing velocity shall be adequate to remove all debris and other undesirable material and a minimum of 2-1/2 feet per second.
- 3.16.3 Cleaning of water Mains 4" and Larger in Diameter: Mains shall be cleaned only in the presence of a AHJ representative. No valves or hydrants owned by the AHJ shall be operated without the express permission of the AHJ. Cleaning shall be accomplished by passing through the pipe a polyethylene pig ("pig") of the appropriate size and density (as manufactured by Poly-Pig or approved equal). Pig(s) shall be furnished by the Contractor. The procedure shall be as follows:
- a. The Contractor shall prepare the main for the installation and removal of pig(s) as required:
 - i. In general, this will consist of furnishing all equipment, material, and labor to satisfactorily install and remove the pig(s).
 - ii. Prior to beginning construction, Contractor shall submit a "pigging" plan to the Department Engineer for approval. No water main shall be installed prior to approval of the plan.
 - iii. Where expulsion of the pig is required through a dead end main, the Contractor shall prevent the backflow of purged water into the main after expulsion of the pig. For pipe 12" or less in diameter, purged water can be prevented from re-entering into the pipe by the temporary installation of pipe and fittings as required to provide a riser with an above ground discharge. On larger pipe, additional excavation of the trench may serve the same purpose.
 - iv. After expulsion of the pig, completion of flushing, and at the direction of the AHJ, the Contractor shall complete work at openings by plugging, blocking, backfilling and completion of all appurtenant work necessary to secure the system.
 - b. Under supervision of the Inspector, pig(s) shall be propelled via water pressure through the main(s) from point of insertion to point of expulsion. Where mains are in the form of a loop, the Contractor shall "pig" the complete system.
 - c. As an alternative to "pigging", dead end pipes of less than 100 feet in length which are difficult to "pig" may be cleaned by flushing. Flushing shall be accomplished in the same manner as that required for pipes less than 4 inches in diameter.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

- 1.1 The construction required herein shall include all appurtenant structures. Wye branches and service lines shall be installed as shown or as located by the owner's representative. Excavation and backfilling shall conform to Sections 02200 EARTHWORK, 02210 TRENCHING AND BACKFILLING FOR UTILITIES and DRAWINGS. Work covered by this section will not be accepted until backfilling and testing connected with work has been completed satisfactorily.
- 1.2 Current specifications of the American Society for Testing Materials (ASTM) and the American National Standards Institute (ANSI) shall apply in all cases where material is covered by an item in these specifications, and all material used under this contract shall conform fully to these current specifications or be removed from the job at the direction of the Owner. Failure of the Owner to condemn material on preliminary inspection shall not be grounds for acceptance if future defects are found.
- 1.3 Contractor shall be responsible for verifying all elevations, dimensions, locations and sizes of existing facilities in the field prior to construction or ordering materials.
- 1.4 The Contractor shall construct and maintain all detours, crossings and temporary approaches that may be required during construction. Maintenance shall be in accordance with the applicable features of Section 150 of the N.C. Standard Specifications for Roads and Structures.
- 1.5 Property Protection:
 - 1.5.1 Trees, fences, poles and all other property shall be protected unless their removal is authorized, and any property not authorized for removal, but damaged by the Contractor shall be restored by the Contractor to the owner's satisfaction.
 - 1.5.2 Signs, mailboxes and other items which must be removed to facilitate construction shall be replaced in a condition equal or better than condition prior to removal. Replacement shall occur immediately following backfill of the trench at the location of each item removed.
 - 1.5.3 All existing drainage shall be maintained at all times on the Project. Any drainage swales, ditches, culverts, etc. blocked by construction activities shall be reopened at the end of the day before leaving the job site.
- 1.6 Encroachment Contracts and Permits:
 - 1.6.1 Prior to actual construction, the Owner shall acquire the necessary encroachments from NCDOT for installations. When working inside the rights-of-way of State system roads for highways, the Contractor shall acquire the necessary permits for his work.
 - 1.6.2 The Contractor shall be responsible for securing all other local and state permits required for the utility construction.
 - 1.6.3 Open cut shall be used for excavation of all sewer mains unless written permission of the Owner is given, or as specified by the encroachment agreement with the N.C. Department of Transportation.

PART 2: MATERIALS

- 2.1 DUCTILE IRON PIPE: All ductile iron pipe shall be manufactured in compliance with ANSI Standard A21.51. The interior of the pipe shall be cement-mortar lined in accordance with ANSI A21.4. The exterior of the pipe shall have a one (1) ml bituminous coating in accordance with ANSI 21.51. The thickness class for ductile iron pipe shall be Class 50 unless required otherwise by the Commission. Pipe shall be in nominal 18-20 foot laying lengths. The pipe joints for ductile iron pipe shall be lipush-on" manufactured in accordance with ANSI 21.11. Polyethylene encasement shall be applied to all underground ductile iron pipe installations. Materials and installation procedures shall be in accordance with ANSI/AWWA C105/A21.5.88.
- 2.2 SEWER SERVICE PIPE: Sewer service pipe shall be schedule 40 PVC - Drain, waste and vent (DWV) pipe in accordance with ASTM D2665 and ASTM D1785.
- 2.3 Polyvinyl Chloride (PVC) Pipe 8"-15". PVC pipe shall conform to the requirements of ASTM D3034 (SDR35). Joints and fabricated fittings shall be elastomeric (gasket) joints and shall be assembled in accordance with the pipe manufacturer's recommendations and Specification D3212. Gaskets shall meet the requirements of ASTM F477. Minimum cell class shall be 12454B. PVC pipe shall be supplied in 13.0 foot lengths.
- 2.4 PVC Composite Pipe. PVC composite pipe shall conform to the requirements of ASTM D2680, Standard Specification for Poly (Vinyl Chloride). Joints and fabricated fittings shall be elastomeric (gasket), joints and shall be assembled in accordance with the manufacturer's recommendations. Minimum cell class shall be 12454B. The pipe shall be similar in all respects to Armco Truss Pipe as manufactured by Contech Construction Products, Inc. PVC composite pipe shall be supplied in 12.5 foot lengths.
- 2.5 Service Fittings
- 2.6 Services from ductile iron pipe less than 18" in diameter shall be provided by means of ductile iron wyes meeting the requirements for water main fittings. Services from ductile iron pipe 18" in diameter and larger shall be provided by wyes
- 2.6.1 Service fittings for use on PVC composite pipe shall be PVC standard gasketed wyes manufactured or approved by the pipe manufacturer and shall conform to the requirements of ASTM D2680.
- 2.6.2 Service fittings for use on PVC (SDR 35) pipe shall be a standard gasketed wyes manufactured or approved by the pipe manufacturer and shall conform to the requirements of ASTM D3034.
- 2.7 PRECAST REINFORCED CONCRETE MANHOLES. Manholes shall be precast and have monolithic bottom sections. Manholes with a depth greater than 6 feet shall have eccentric cones, manholes with a depth of 6 feet or less shall have either an eccentric or concentric cone. Manholes shall conform to latest ASTM C-478 specifications. Top slabs when used, shall be satisfactory for H-20 highway loading. Joints shall be watertight and conform to either the latest ASTM C-443 specifications for "O" ring joints Sewer 3 or the latest ASTM C-478 specifications for section joints designed for cold applied sealing compound. Sealing compound shall be CPS-210 as manufactured by Concrete Products Supply Company, or CS 102 as manufactured by Concrete Sealants. Points of exit and entry for all pipe including services shall be provided with flexible manhole sleeves and all stainless steel take up clamps in accordance with ASTM C-923. Points of entry for mains or services which are added after fabrication of the manhole shall be provided by coring and installation flexible sleeve. All pipes shall extend through the manhole a

minimum of 2 inches. Manholes with preformed invert channels and benches may be utilized. Points of pipe exit and entry shall conform with the above paragraph. Manholes that are field tested shall be done in accordance with the Standard Details. All Manholes shall be set on crushed aggregate of at least 1 ft. depth. All pinholes shall be filled with non-shrink grout. Tie into existing Manhole must be made by machine coring.

- 2.7.1 MANHOLE FRAMES AND COVERS. Manhole rings and covers shall be manufactured in the USA of Class 30, gray cast iron conforming to the requirements of ASTM-A48 (latest revision thereof). The manufacturer's name and part number shall be cast into each component and the words "Sanitary Sewer" shall be cast into the cover. Pick holes shall be the non-penetrating type. Bearing surfaces of both ring and cover shall be machined to insure proper fit and to prevent rattling. Non watertight units shall be either MH-RCR-2001 by Dewey Bothers, V-1384 by Vulcan Foundry, or USF 669 ring and KL cover by US Foundry. Watertight units shall be either MH-RCR-3000W by Dewey Brothers or USF 579 ring and DC-SSG cover by US Foundry. When required to be lockable, covers shall contain a locking device comprised of a stainless steel pentagon head bolt locking device which functions in the manner of a quarter turn fastener. All castings shall meet industry standards in regard to appearance and tolerances for dimensions and weight. Castings do not have to be painted.
- 2.7.2 MANHOLE STEPS. Manhole steps shall be constructed of 1/2" grade 60 steel bars with a plastic coating and shall meet federal specification RR- F-621C. Maximum vertical step spacing shall be sixteen inches (16") on center.
- 2.8 MASONRY: Masonry construction shall conform to N.C. Department of Transportation Standard Specifications and latest revision Section 940. Mortar joints shall be thoroughly filled and the thickness shall not be more than three-eighths (3/8) of an inch.
- 2.9 REINFORCED CONCRETE. Reinforced concrete used in construction of piers, manholes and other structures shall conform to the applicable sections of the N.C. Department of Transportation Standard Specifications, revised January 1, 1990. Concrete used in the structures shall be Class A, 3, 000-pound test in accordance with Section 900. Reinforcing steel shall conform to ASTM A-615, Grade 60 unless otherwise specified and shall conform to N.C. Department of Transportation Standard Specifications Section 425.
- 2.10 STONE BEDDING. Stone used for bedding of sewer mains, manholes and concrete piers shall be granite crusher run stone (NCDOT Size No. 57) as per Section 905 of N.C. Department of Transportation Standard Specifications as revised January 1, 1990 and in accordance with Section 02210, TRENCHING AND BACKFILLING FOR UTILITIES.
- 2.11 TRANSITION COUPLINGS. The preferred transition connection between different sewer line materials shall be a standard manhole installation. Pipe material changes between manholes may be permitted provided that there is not a substantial difference in inside diameters, a smooth uniform flow line is maintained, and a watertight rubber sleeve, mechanical coupler conforming to ASTM C-425 is used to make the transition. All metal hardware shall be stainless steel. Transition sleeves shall be manufactured by Fernco or Indiana Steel.
- 2.12 CLEAN-OUTS: Shall be constructed of pipe and fittings which also meet the ASTM requirement for Schedule 40 PVC-DWV pipe. Cleanout caps shall be Charlotte 110 or Jones BP134CSK flush cap except cleanouts in paved locations shall be constructed of cast iron and have a brass plug. Cleanouts located in traffic or paved areas may be constructed of PVC except for the upper two feet of the riser which shall be constructed of cast iron soil pipe and have a brass cap.
- 2.13.1 STEEL ENCASEMENT PIPE: Steel encasement pipe shall be spiral welded or smooth wall seamless, consisting of grade "B" steel with a minimum yield strength of 35,000 psi and

manufactured in accordance with ASTM A139 and A283. The pipe thickness shall be in accordance with the requirements of the right-of-way owner, but in no case less than that shown in the following table. The ends shall be beveled and prepared for field welding at the circumferential joints.

- 2.13.2 METALLIC LOCATOR TAPE: Provide continuous metallic locator tape above all pipe installation as per Drawings.

MINIMUM WALL THICKNESS FOR STEEL ENCASEMENT PIPE

<u>NOMINAL DIAMETER IN INCHES</u>	<u>MINIMUM THICKNESS IN INCHES:</u>
4 - 12-3/4	0.188
14	0.219
16- 18	0.250
20	0.281
22	0.312
24	0.344
26	0.375
28- 30	0.406
32	0.438
34- 36	0.469
38- 42	0.500

The encasement pipe shall be uncoated inside and out.

Encasement pipe and joints shall be of leakproof construction, capable of withstanding design loading. The inside diameter of the encasement pipe shall be at least 2 inches greater than the largest outside diameter of the carrier pipe, joints or couplings, for carrier pipe less than 6 inches in diameter; and at least 4 inches greater for carrier pipe 6 inches and larger in diameter. It shall, in all cases, be great enough to allow the carrier pipe to be removed subsequently without disturbing the casing pipe or roadbed.

- 2.14 FORCE MAIN PIPE AND OF APPURTENANCES: Steel

- 2.14.1 Sewer force main pipe shall be a minimum of Class 200 PVC pipe or Class 50 ductile iron pipe.
- 2.14.2 PVC shall be Class 200 C-900 conforming to ASTM D1784 and ASTM D2241 (latest revisions). Fittings for PVC force main shall be ductile iron meetings the requirements of ANSI A21.10 and shall be designed for a minimum working pressure of 150 psi plus 100 psi surge pressure. The interior of all fittings shall be cement-mortar lined in accordance with ANSI 21.4 and the exterior of the fittings shall be bituminous coated in accordance with ANSI 21.51.
- 2.14.3 Ductile iron force main and fittings shall meet the requirements for ductile iron water main set forth in Section 02713.
- 2.14.4 Directional Bored Force Mains:
- 2.14.5 High Density Polyethylene (HDPE) Force Main: shall conform to AWWA C9906 and shall have a wall thickness and pressure rating equivalent to C-900 Class 200 PVC pipe. Pipe shall be DISCOPIPE or approved equal.

PART 3: CONSTRUCTION METHODS

- 3.1 GENERAL: Pipe shall be installed in accordance with specifications and recommendations by the Manufacturer. Before any installation is begun, the Contractor shall notify NC One Call at least 48 hours prior to commencing construction in order that existing utilities in the area may be flagged or staked. The Contractor shall be responsible for damage to any existing overhead and underground utility system.
- 3.2 HANDLING AND STORING MATERIALS:
- 3.2.1 The Contractor shall be responsible for the shipping and storing of all sanitary sewer materials. Any material which is damaged or defective shall be replaced by the Contractor at his own expense.
- 3.2.2 The loading and unloading of all pipe, manholes and other accessories shall be in accordance with the manufacturer's recommended practices and shall at all times be performed with care to avoid any damage to the material.
- The Contractor shall locate and provide the necessary storage areas for materials and equipment. If private property is being used for storage areas, Contractor must have the written consent from the property owner.
- 3.2.3 All materials once on the job site shall be stored in accordance with the manufacturer's recommendations.
- 3.2.4 The Contractor shall be responsible for safeguarding and protecting all material and equipment stored on the job site. The Contractor shall be responsible for the storage of materials in a safe and workmanlike manner to prevent injuries, during and after working hours, until project completion.
- 3.3 PIPE INSTALLATION:
- 3.3.1 PIPE INSTALLATION: Flexible thermoplastic sewer pipe shall be installed in accordance with ASTM D2321- 83a, except as modified by these specifications and the specific recommendations of the pipe manufacturer.
- 3.3.2 CUTTING OF PIPE: Pipe cutting, where permitted, shall be done in accordance with the written recommendations of the pipe manufacturer. Only factory cut ends shall be used for solvent weld joints.
- 3.3.3 TRENCHING: Trenches shall be excavated in straight lines and uniformly sloped between manholes or junction structures. The trench shall be excavated a minimum of six inches (6") below the pipe bottom in order to receive the required 6" bedding of No. 57 crushed stone. Bed and haunch pipe in accordance with requirements set forth in Section 02210, TRENCHING AND BACKFILLING FOR UTILITIES.
- 3.3.4 FOUNDATION STONE: The Contract Documents shall provide for the construction of a Foundation of No. 57 crushed stone in the bottom of trenches when unstable material is encountered. Such unstable material shall be removed to the depth required by the Commission and replaced with No. 57 stone such that the pipe will be adequately supported throughout the entire length. Excavation below the planned pipe invert elevation as shown on the Approved Plans shall be refilled with No. 57 crushed stone. This stabilization stone shall be in addition to the required 6" of No. 57 stone bedding.

- 3.3.5 DIRECTIONAL BORING: Direction boring / drilling installation shall be accomplished where required on the Plans or in the Special Provisions to minimize disturbance of existing surface improvements. The Contractor shall submit boring / drilling pit locations to the Owner before beginning construction. The drilling equipment shall be capable of installing continuous runs of pipe without intermediate pits, a minimum distance of 200 feet. The guidance system shall be capable of installing pipe within 1-1/2 inch of the plan vertical dimensions and 2-inches of the plan horizontal dimensions. The Contractor shall be required to remove and reinstall pipes, which vary in depth and alignment from these tolerances. Pull back forces shall not exceed the allowable pulling forces for the pipe being installed. Drilling fluid shall be a mixture of water and bentonite clay. Disposal of excess fluid and spoils shall be the responsibility of the Contractor.
- 3.3.6 BORING AND JACKING: All boring and jacking installation shall be accomplished with the use of encasement pipe which at a minimum meets these specifications. Install steel pipe encasements by boring and or jacking or by pushing the casing pipe through a bored hole. Ensure that the encasement is installed true to line and grade.

The boring machine shall be designed to bore and push or jack the casing on a controlled grade and line in a continuous operation. The boring auger shall not be of a greater diameter than the outside diameter of the casing.

Bore progressively ahead of the advancing pipe while spoil is removed by the auger back through the pipe.

Butt-weld each new section of the encasement pipe to the section previously jacked into place as the boring operation continues.

Protect ends of encasement in an acceptable manner to prevent the entrance of foreign materials or debris.

If voids are encountered or occur outside the encasement pipe, grout holes shall be installed in the top section of the encasement pipe and the voids filled with 1:3 portland cement grout at sufficient pressure to prevent settlement in the roadway.

In the event an obstruction is encountered during the boring and jacking operation, notify the ENGINEER of the obstruction and obtain written authorization from the ENGINEER prior to proceeding with the premature termination of that boring.

When premature termination of a boring is authorized, the auger is to be withdrawn and the excess pipe is to be cut off, capped, and filled with 1:3 portland cement grout at sufficient pressure to fill all voids before moving to another boring site.

Ensure that encasement pipe is installed at the alignment and grade shown on the drawings. Report, in writing, any deviation in the alignment and grade from that shown on the drawings.

Joint carrier pipe in accordance with manufacturer's specifications.

Carefully secure pipe supports to each joint of carrier pipe. Supports shall be placed at each end of the casing, at each pipe bell for DIP, and at intervals not greater than 4 feet for PVC or ABS pipe. For gravity sewer the supports shall be constructed to maintain the proper slope of the line even when the casing alignment deviates from the slope shown on the drawings.

Carefully push carrier pipe through encasement ensuring that the assembly is not damaged.

Ensure that the carrier pipe is installed at the alignment and grade shown on the drawings.

3.4 **ADJACENT FACILITIES**

3.4.1 **WATER LINES:** Unless otherwise shown on the drawings, the sewer shall not be located closer than 10 feet to a water line, except where the bottom of the water line is greater than 18 inches above the top of the sewer pipe. Where the vertical separation is less than 18 inches, or where the sewer line crosses above the water line, both the water line and sewer line shall be constructed of ductile iron pipe, for a distance of 10' in each direction from the crossing. The section of water line pipe shall be centered at the crossing.

3.5: **BACKFILL:** Backfill in accordance with Section 02210 TRENCHING AND BACKFILLING FOR UTILITIES. Provide continuous metallic locator tape above all pipe installations as per Drawings.

3.6 **SERVICE CONNECTION:** Service Connections shall be installed at locations shown on the drawings, or as designated by the owner's representative and be at right angles to the gravity sewer.

3.6.1 Service Connections shall consist of a wye branch, fittings, clean-out, and 411 pipe, unless otherwise shown or directed.

3.6.2 Service Laterals shall include a clean-out located at the right-of-way limit five feet (5') downstream of the water meter, unless otherwise noted on the plans.

3.7 **MANHOLES:**

3.7.1 **GENERAL:** Manholes shall be constructed of precast concrete rings with cast iron frames and covers, and in accordance with the drawings. The manhole inverts shall be constructed with a width and height equal to that of the effluent pipe and shall be so brushed and troweled that a minimum energy loss occurs in the manhole due to invert roughness. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. Manholes shall be provided with steps of acceptable design not less than 10 inches in width, built into and securely anchored in the walls. Steps shall be spaced uniformly approximately 16 inches.

3.7.2 **JOINTING AND PLASTERING:** Installation of water tight joints between precast rings shall conform to either ASTM C443 standard for "o" ring joints, or the ASTM C478 standard for section joints designed for cold applied sealing compound in accordance with recommendations of the manufacturer. The sealing compound shall be CPS-210 as manufactured by Concrete Products Supply Company or CS102 as manufactured by Concrete Sealants.

3.8 **TESTING:**

3.8.1 **GENERAL:** The Contractor shall be responsible for providing all pumps, gages, instruments, test equipment and personnel required for testing operations. The Contractor shall also be responsible for cleaning and pre-testing the sewer system extension prior to notifying the Engineer and arranging for final inspections and tests.

All defects in the pipeline and appurtenances shall be remedied by the Contractor at no additional cost to the Owner.

The Contractor shall be required by the Contract Documents to clean and pretest the sewer system extension prior to notifying the Engineer and arranging for final inspections and test.

The Engineer shall be contacted prior to testing to schedule the test time such that the Engineer representative may be present. The Owners representative shall be present during all testing.

3.8.2 TESTING SEQUENCE: The following test sequence shall be used unless otherwise approved by the Owner:

1. Perform a visual inspection
2. Correct defects revealed by visual inspection
3. Perform leakage testing
4. Make any necessary repairs
5. Make the necessary retests

3.8.3 VISUAL INSPECTION: The sewer shall be inspected from every manhole by use of mirrors, television cameras or other devices. The lines shall appear circular in cross section with no noticeable deflection. Lines which do not meet specified tolerances or which have structural defects shall be replaced to meet the requirements of the Engineer prior to leakage testing.

3.8.4 LEAKAGE TESTING: All segments of completed line, including services, shall be tested for leakage by low pressure air test. Testing shall be performed in the presence of the Engineer or his representative.

A. The Contractor shall remedy all visible leaks in pipes, manholes, and appurtenances.

B. Low Pressure Air Test: Tests for leakage for individual line segments shall be made by low pressure air test. Test shall conform to the requirements as follows:

1. All air testing and retesting results shall be recorded on copies of the Air Data Sheets enclosed herein and submitted to the Engineer for approval.
2. Air leakage testing of installed system shall be performed with continuous monitoring gauge no less than 4 inches in diameter with minimum divisions of 0.10 psi and an accuracy of plus or minus 0.04psi. All air used shall pass through a single, above ground control panel visible to the Project Representative during the testing.
3. Determine the ground water elevation and determine the average ground water head above the section of line being tested. Adjust the following test pressures by adding 0.43 psig per foot of ground water head above the pipe invert.
4. Pressurize the system to 4.0 psig (greater than average ground water pressure). Throttle the air supply to maintain that constant pressure for at least 2 minutes. The air pressure supply shall then be disconnected from the system or shut off. Do not exceed 9.0 psig in the system.

5. As a safety precaution, no one shall be allowed in a manhole after the air pressure is increased in the sewer line. If the Resident Inspector suspects that the test plug may be leaking, the pressure first shall be relieved before any adjustments are made to eliminate air leakage at the plug. The Contractor may precoat the plug with a soap solution to check the plugs for leakage.
6. Observe the continuous monitoring gauge while decreasing the pressure to no less than 3.5 psig (greater than ground water pressure). At a reading of 3.5 psig (adjusted) or any convenient observed pressure reading between 3.5 and 4.0 psig (adjusted), timing shall commence with a stop watch or other timing device that is at least 99.8 percent accurate.

Measure the time interval for pressure to drop 1.0 psig.

7. If the time, shown in the following Table I for the designated line size and length, elapses before the air pressure drops 1.0 psig; the section undergoing test may be discontinued once the prescribed time has elapsed even though the 1.0 psig drop has not occurred. Record all readings.
8. If the pressure drops 1.0 psig before the appropriate time shown in the Table I has elapsed, the air loss rate shall be considered excessive and the section of pipe has failed the test. Record all readings.
9. If lateral sewers are included in the test section, their lengths may be ignored for computing and required test times. The test will be slightly more severe. In the event a test section having a total surface area less than 625 square feet, fails to pass the air test when lateral sewers have been ignored, the test time shall be recomputed to include all lateral sewers using the following formula:

Where T = Shortest allowable time, in seconds for the air pressure to drop 1.0 psig: $K = 0.000419 (D_1L_1 + D_2L_2 + \dots + D_nL_n)$, but not less than 2.0"; $Q = 0.0015$ cu.ft./min./sq.ft. of internal surface) D_1, D_2, \dots, D_n = Nominal diameters of the different size being tested. L_1, L_2, \dots, L_n = Respective lengths of the different size pipes being tested.

If the recomputed test time is short enough to allow the section to pass, the section undergoing test shall have passed.

10. If the sections fail the air test, the Contractor shall determine at his own expense, the source, or sources of leakage, and shall repair or replace all defective materials and workmanship.
11. No sealant shall be used in the newly installed sewers to correct the leaks without prior approval of the Engineer.
12. The extent of the type of repair which may be allowed shall be subject to the approval of the Engineer.
13. The repaired pipe installation shall be retested and required to meet the requirements of this test.

- C. Infiltration or Exfiltration Test: for leakage shall not be accepted without prior written approval of the Engineer. For these methods to be considered, the Contractor shall state in writing reasons for this consideration.

Should water exfiltration or infiltration testing be allowed, the maximum leakage rate shall be 50 gallons per inch of pipe diameter per mile of pipe per 234 hours; test ground water depths must be 4 feet minimum; all liquid measurements must be made with a Pomon-O-Weir or equal device. V-notch where measurements shall not be allowed.

- 3.8.5 DEFLECTION TESTING FOR PVC (SDR 35): If PVC (SDR 35) sewer pipe is utilized, deflection testing shall be required with a rigid device (mandrel) sized to pass 5% or less deflection (or deformation) of the pipe.

Deflection test 100% of the total footage of solid wall PVC pipe. Deflection test is not required on PVC Truss Pipe or Ductile Iron Pipe.

The mandrel device shall be cylindrical in shape and constructed with nine or ten evenly spaced arms or prongs. Mandrels with less than nine arms will not be approved for use. The dimensions of the mandrel shall be as listed in the table below:

Note: The diameter of the mandrel shall carry a tolerance of plus or minus 0.01 inch.

Nominal Diameter	Contact Length	Mandrel Diameter ASTM 3034 SDR 35	Mandrel Diameter ASTM D2680
8"	8"	7.28"	7.36"
10"	10"	9.08"	9.26"
12"	12"	10.79"	11.16"
15"	12"	13.20"	14.01"

Allowance for piping wall thickness tolerances or ovality (from heat, shipping, poor production, etc.) shall be deducted from the "D" dimension but shall not be counted in as a part of the 5% or lesser deflection allowance.

The mandrel shall be hand pulled by the Contractor through all sewer lines in the presence of the Engineer or his Representative. Any sections of the sewer not passing the mandrel shall be uncovered and the Contractor shall reread or replace the sewer to the satisfaction of the Engineer. These repaired sections shall be retested.

The inspection shall be conducted no earlier than 30 days after reaching final trench backfill grade, provided in the opinion of the Engineer that sufficient water densification or rainfall has occurred to thoroughly settle the soil throughout the entire trench depth. If this cannot be achieved in the time after installation prior to the project completion date, then the mandrel size shall be increased to measure 1/3 less of a deflection allowance.

Contact length shall be measured between points of contact of the mandrel arm. This length shall not be less than that shown in the table above.

The mandrel may not be used until approved by the Engineer. Proving rings provided by contractor shall be used to assist in this. Drawings of the mandrel with complete dimensions shall be furnished by the Contractor to the Engineer for each diameter and specification of pipe.

The mandrel device shall be as manufactured by H and H Fabricating of Fairfield, Ohio or Wortco, Inc. of Franklin Ohio; and shall be approved by the Engineer."

- 3.8.6 MANHOLE TESTING: Each manhole shall be tested for leakage immediately after assembly and prior to backfilling. The test method shall be the vacuum test.
- A. All lift holes shall be plugged with non-shrink grout.
 - B. All pipes entering the manhole shall be plugged.
 - C. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendation.
 - D. A vacuum of ten inches (10") of mercury shall be drawn and the vacuum shut off. With the valves closed, the time shall be measured for the vacuum to drop to nine inches (9") . The manhole shall pass if the time is greater than sixty (60) seconds for forty-eight inches (48") diameter, seventy-five (75) seconds for sixty inch (60"), and ninety (90) seconds for seventy-two inch (72") diameter manholes.
 - E. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.
- 3.8.7 FORCE MAIN TESTING: Shall be in accordance with paragraph 3.12 of Section 02713 Water Mains. It is the Contractor's responsibility to install taps for pressure testing in adequate locations to identify any leaks and pass hydrostatic test.

END OF SECTION

PART 1 – GENERAL

1.01 DESCRIPTION:

Scope – This section specifies high density polyethylene pipe (HDPE) and fittings for water utility use as indicated on the Drawings, and as specified herein.

- A. Furnish, Install, and Test HDPE pipe as indicated and specified in this section, and as referred to in related sections, and the Drawings
- B. The primary installation method is burial. The means and methods, including the testing for acceptance shall conform to all applicable standards as noted herein with the intention of providing a leak-free system to the owner.

1.02 RELATED WORK

- A. The following sections are incorporated by reference, “MINIMUM CONTRACT REQUIREMENTS FOR PRIVATELY FINANCED AND CONSTRUCTED WATER LINE EXTENSIONS TO THE JOHNSTON COUNTY WATER SYSTEM.”

1.03 REFERENCES

- A. To the extent referenced in this specification section, the standards and documents listed below are included, and made a part of this specification.
- B. In the event of a conflict, the requirements of this specification section prevail.
- C. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the bid date of the project.

ANSI/AWWA www.awwa.org

- A. ANSI/AWWA C901-08 Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm) for Water Service
- B. ANSI/AWWA C906-07 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission
- C. ANSI/AWWA C651 Standard for Disinfecting Water Mains
- D. AWWA M55 Manual of Water Supply Practices, PE Pipe–Design and Installation

Plastics Pipe Institute, PPI www.plasticpipe.org

- A. PPI Handbook of Polyethylene Pipe – 2009 (2nd Edition)
- B. PPI TR-33 Generic Butt Fusion Joining Procedure for Polyethylene Gas Pipe
- C. PPI TR-34 Disinfection of Newly Constructed Polyethylene Water Mains
- D. PPI TR-41 Generic Saddle Fusion Joining Procedure for Polyethylene Gas Piping
- E. PPI TN-42 Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects (2009)

NSF www.nsf.org

- A. NSF / ANSI 61 Drinking Water System Components–Health Effects

ASTM www.astm.org

- A. ASTM F 714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
- B. ASTM F905 Standard Practice for Qualification of Polyethylene Saddle-Fused Joints
- C. ASTM F 1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
- D. ASTM F 1290 Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings
- E. ASTM F 1412 Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems
- F. ASTM F1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

- G. ASTM F 2164 Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure
- H. ASTM F2206 Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock
- I. ASTM D 2239 Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
- J. ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- K. ASTM F 2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
- L. ASTM D 2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
- M. ASTM D 2737 Standard Specification for Polyethylene (PE) Plastic Tubing
- N. ASTM D 2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping
- O. ASTM D 3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
- P. ASTM D 3350-08 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

1.04 SYSTEM DESIGN PARAMETERS

- A. The *polyethylene* system working pressure rating *accommodates* the normal operating pressure and the repetitive surges. The pressure rating applies at 80°F or less.
- B. Per AWWA 901 and C906, the repetitive surge pressure allowance is one half the pressure class of the pipe, and the occasional surge over pressure allowance is equal to the pressure class of the pipe. Allowable Total Pressure during Recurring Surge conditions equals 1.5 times the pipe's pressure class. Allowable Total Pressure during Occasional Surge conditions equals 2.0 times the pipe's pressure class.

PART 2 A- PRODUCTS FOR 3 INCH AND SMALLER PIPE PER AWWA C901

2A.01 PIPE

- A. Polyethylene pipe shall be made from a HDPE material having a minimum material designation code of PE 4710 or PE 3608. The material shall meet the requirements of ASTM D 3350 and shall have a minimum cell classification of PE445474C for PE 4710 and PE345464C for PE 3608. In addition, the pipe shall be listed as meeting NSF-61.
- B. The pipe shall meet the requirements of AWWA C901
- C. HDPE pipe shall be rated for use at a pressure class of 200 psi DR 9.

2A.02 FITTINGS

- A. Butt Fusion Fittings - Fittings shall be made of either PE4710 or PE 3608, with a minimum Cell Classification as noted in 2A.01A. Butt Fusion Fittings shall meet the requirements of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans.
- B. Markings for molded fittings shall comply with the requirements of ASTM D 3261. Fabricated fittings shall be marked in accordance with ASTM F 2206. Socket fittings shall meet ASTM D 2683.
- C. Electrofusion Fittings - Fittings shall be PE4710 or PE 3608, with a minimum Cell Classification as noted in 2A.01A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.

- D. Flanges and Mechanical Joint Adapters (MJ Adapters) – Flanges and Mechanical Joint Adapters shall be PE4710 or PE 3608, with a minimum Cell Classification as noted in 2A.01A. Flanged and Mechanical Joint Adapters can be made to ASTM D 3261 or if machined, must meet the requirements of ASTM F 2206. Flanges and MJ Adapters shall have a pressure rating equal to the pipe unless otherwise specified on the plans. Markings for molded or machined flange adapters or MJ Adapters shall be per ASTM D 3261. Fabricated (including machined) flange adapters shall be per ASTM F 2206. Van-Stone style, metallic (including stainless steel), convoluted or flat-plate, back-up rings and bolt materials shall follow the guidelines of Plastic Pipe Institute Technical Note # 38, and shall have the bolt-holes and bolt-circles conforming to one of these standards: ASME B-16.5 Class 150, ASME B-16.47 Series A Class 150, ASME B-16.1 Class 125, or AWWA C207 Class 150 Series B, D, or E. The back-up ring shall provide a long-term pressure rating equal to or greater than the pressure-class of the pipe with which the flange adapter assembly will be used, and such pressure rating shall be marked on the back-up ring. The back-up ring, bolts, and nuts shall be protected from corrosion by a system such as paint, coal-tar epoxy, galvanization, polyether or polyester fusion bonded epoxy coatings, anodes, or cathodic protection, as specified by the project engineer.
- E. Service connections shall be electrofusion saddles with a brass or stainless steel threaded outlet, electrofusion saddles, sidewall fusion branch saddles, tapping tees, or mechanical saddles. For electrofusion saddles with threaded outlet the size of the outlet shall be one inch IPS unless a larger size is shown on the plans. Electrofusion saddles shall be made from materials required in part 2A.02 B. Electrofusion Fittings. For sidewall fusion saddles, the size of the saddle shall be as indicated on the plans. The saddle can be made in accordance to ASTM D 3261 or ASTM F 2206. After installation, approximately ¼” of the PE pipe shall be visible beyond the saddle to confirm that proper surface preparation occurred. Saddle faces that do not provided ¼ inch of area beyond the saddle are not acceptable. Tapping tees shall be made to ASTM D3261 or D2683. Mechanical strap-on saddles can only be used where there use on PE pipe is approved by the mechanical saddle manufacturer. The body of the saddle shall be stainless steel, epoxy coated cast iron or brass. The gasket material and design must be acceptable for PE pipe. The outlet shall be threaded for one inch IPS unless a larger size is shown on the plans. Mechanical strap-on saddles will be installed per the manufacturer's instructions.

PART 2 B– PRODUCTS FOR 4 INCH AND LARGER PIPE PER AWWA C906

2B.01 – PIPE

- A. Polyethylene pipe shall be made from HDPE material having a material designation code of PE3608 or higher. The material shall meet the requirements of ASTM D 3350 and shall have a minimum cell classification of PE345464C. In addition, the material shall be listed as meeting NSF-61.
- B. The pipe and fittings shall meet the requirements of AWWA C906.

2B.02 FITTINGS

- A. Butt Fusion Fittings - Fittings shall be made of HDPE material with a minimum material designation code of PE3608 and with a minimum Cell Classification as noted in 2B.01A. Butt Fusion Fittings shall meet the requirements of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All fittings shall meet the requirements of AWWA C906.
- B. Markings for molded fittings shall comply with the requirements of ASTM D 3261. Fabricated fittings shall be marked in accordance with ASTM F 2206. Socket fittings shall meet ASTM D 2683.
- C. Electrofusion Fittings - Fittings shall be made of HDPE material with a minimum material designation code of PE 3608 and with a minimum Cell Classification as noted in 2B.01A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits, and have nominal burst values of four times the Working Pressure Rating (WPR) of the fitting. Markings shall be according to ASTM F 1055.

- D. Flanges and Mechanical Joint Adapters (MJ Adapters) – Flanges and Mechanical Joint Adapters shall have a material designation code of PE3608 or higher and a minimum Cell Classification as noted in 2B.01A. Flanged and Mechanical Joint Adapters can be made to ASTM D 3261 or if machined, must meet the requirements of ASTM F 2206. Flanges and MJ Adapters shall have a pressure rating equal to the pipe unless otherwise specified on the plans. Markings for molded or machined flange adapters or MJ Adapters shall be per ASTM D 3261. Fabricated (including machined) flange adapters shall be per ASTM F 2206. Van-Stone style, metallic (including stainless steel), convoluted or flat-plate, back-up rings and bolt materials shall follow the guidelines of Plastic Pipe Institute Technical Note # 38, and shall have the bolt-holes and bolt-circles conforming to one of these standards: ASME B-16.5 Class 150, ASME B-16.47 Series A Class 150, ASME B-16.1 Class 125, or AWWA C207 Class 150 Series B, D, or E. The back-up ring shall provide a long-term pressure rating equal to or greater than the pressure-class of the pipe with which the flange adapter assembly will be used, and such pressure rating shall be marked on the back-up ring. The back-up ring, bolts, and nuts shall be protected from corrosion by a system such as paint, coal-tar epoxy, galvanization, polyether or polyester fusion bonded epoxy coatings, anodes, or cathodic protection, as specified by the project engineer.
- E. Service connections shall be electrofusion saddles with a brass or stainless steel threaded outlet, electrofusion saddles, sidewall fusion branch saddles, tapping tees, or mechanical saddles.

PART 3 – EXECUTION

3.01 JOINING METHODS

- A. Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. All fusion joints shall be made in compliance with the pipe or fitting manufacturer's recommendations. Fusion joints shall be made by qualified fusion technicians per PPI TN-42.
- B. Saddle fusion: Saddle fusion shall be done in accordance with ASTM F 2620 or TR-41 or the fitting manufacturer's recommendations and PPI TR-41. Saddle fusion joints shall be made by qualified fusion technicians. Qualification of the fusion technician shall be demonstrated by evidence of fusion training within the past year on the equipment to be utilized on this project. (ASTM F905).
- C. Electrofusion: Electrofusion joining shall be done in accordance with the manufacturers recommended procedure. Other sources of electrofusion joining information are ASTM F 1290 and PPI TN 34. The process of electrofusion requires an electric source, a transformer, commonly called an electrofusion box that has wire leads, a method to read electronically (by laser) or otherwise input the barcode of the fitting, and a fitting that is compatible with the type of electrofusion box used. The electrofusion box must be capable of reading and storing the input parameters and the fusion results for later download to a record file. Qualification of the fusion technician shall be demonstrated by evidence of electrofusion training within the past year on the equipment to be utilized for this project.
- D. Mechanical:
1. Mechanical connection of HDPE to auxiliary equipment such as valves, pumps, and fittings shall use mechanical joint adapters and other devices in conformance with the PPI Handbook of Polyethylene Pipe, Chapter 9 and AWWA Manual of Practice M55, Chapter 6.
 2. Mechanical connections on small pipe under 3" are available to connect HDPE pipe to other HDPE pipe, or a fittings, or to a transition to another material. The use of stab-fit style couplings is allowed, along with the use of metallic couplings of brass and other materials. All mechanical and compression fittings shall be recommended by the manufacturer for potable water use. When a compression type or mechanical type of coupling is used, the use of a rigid tubular insert stiffener inside the end of the pipe is recommended.
 3. Mechanical couplings that wrap around the pipe and act as saddles are made by several manufacturers specifically for HDPE pipe. All such saddles, tapping saddles, couplings, clamps etc. shall be recommended by the manufacturer as being designed for use with HDPE pipe at the pressure class listed in this section.

4. Unless specified by the fitting manufacturer, a restraint harness or concrete anchor is recommended with mechanical couplings to prevent pullout.
 5. Mechanical coupling shall be made by qualified technicians. Qualification of the field technician shall be demonstrated by evidence of mechanical coupling training within the past year. This training shall be on the equipment and pipe components to be utilized for this project.
- E. Joint Recording - The critical parameters of each fusion joint, as required by the manufacturer and these specifications, shall be recorded either manually or by an electronic data logging device. All fusion joint data shall be included in the Fusion Technician's joint report.

3.02 INSTALLATION

- A. Buried HDPE pipe and fittings shall be installed in accordance with ASTM D2321 or ASTM D2774 for pressure systems and AWWA Manual of Practice M55 Chapter 7.
- B. Pipe embedment - Embedment material should be Class I, Class II, or Class III, materials as defined by ASTM D-2321 Section 6. The use of Class IV and Class V materials is not recommended, however it may be used only with the approval of the engineer and appropriate compaction.
- C. Bedding: Pipe bedding shall be in conformance with ASTM D2321 Section 8. Compaction rates should be as specified in ASTM D2321. Deviations shall be approved by the engineer.
- D. Haunching and backfill shall be as specified in ASTM D 2321 Section 9 with Class I, II, or III materials. Compaction shall be in excess of 85% Proctor

3.03 TESTING

- A. Hydrostatic leakage testing is recommended and shall comply with ASTM F 2164, ASTM F 1412, AWWA Manual of Practice M55 Chapter 9, and PPI Handbook of Polyethylene Pipe Chapter 2 (2nd Edition). If the test section fails this test, the Contractor shall repair or replace all defective materials and/or workmanship at no additional cost to the Owner.
 1. There is no leakage allowance for a section of heat-fusion joined polyethylene piping, because properly made heat fusion joints do not leak. Other types of joints or connections in the system may have a leakage allowance. Contact the joint or connection manufacturer for information. When test pressure is applied, polyethylene pipe will expand slightly due to elasticity and Poisson effects. To compensate for expansion, make-up water is added during the initial expansion phase. The amount of make-up water (expansion allowance) will vary because expansion is not linear. This procedure compensates for expansion with an initial expansion phase, followed by a test phase. In the test phase, expansion is suspended by slightly reducing test pressure.
 2. Testing shall be done only in the presence of a Commission's Representative. Testing shall be performed using a suitable pump and an accurate gauge graduated in 1.0 psi increments. The section of the main to be tested shall be subjected to a test pressure of 150 psi
 3. *Pressurizing—Initial Expansion Phase*—When the test section is completely filled and purged of air, gradually increase pressure in the test section to the required test pressure.
 - a. If the test pressure cannot be attained, or if it takes an unreasonably long time to reach test pressure, there may be faults such as excessive leakage, entrapped air, or open-valving, or the pressurizing equipment may be inadequate for the size of the test section. If such faults exist, discontinue pressurizing, and correct them before continuing.
 - b. Add make-up water as necessary to maintain maximum test pressure for 4 h.
 4. *Test Phase*—Reduce test pressure by 10 psi (1.45 kPa) and monitor pressure for 1 h. Do not increase pressure or add make-up water

5. *Pass/Fail Criteria*—If no visual leakage is observed, and pressure during the test phase remains steady (within 5 % of the test phase pressure) for the 1 h test phase period, a passing test is indicated.

B. Pneumatic (compressed air) leakage testing of HDPE pressure piping is prohibited for safety reasons.

3.04 CLEANING AND DISINFECTING

- A. Cleaning and disinfecting of potable water systems shall be in accordance with AWWA C651 and AWWA Manual of Practice M55 Chapter 10, and PPI Handbook of Polyethylene Pipe Chapter 2 (2nd Edition).
- B. After installation and pressure testing, new water mains should be disinfected according to AWWA C651.
- C. The disinfection chemicals should be limited to less than 12% active chlorine. The duration of the disinfection should not exceed 24 hours.
- D. Upon completion, the system should be thoroughly flushed with fresh water, and retested to verify the disinfectant chlorine level has been reduced to potable drinking water concentrations in all service water tubing and branch lateral pipes.

END OF SECTION

RELATED DOCUMENTS

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this section.

PART 1 - GENERAL

RELATED WORK SPECIFIED ELSEWHERE:

Section 02200 Earthwork

DESCRIPTION OF WORK:

The extent of storm sewer collection system work and materials required are shown on drawings.

Storm Sewer collection system may include, in complete assemblies, but is not limited to, all of the following:

- Storm sewer pipe, RCP and PVC.
- PVC Plastic Structures for Underground Drainage Piping System.
- Trench Drains
- Rip Rap.
- Catch basins / Manholes

QUALITY ASSURANCE:

CODE AND STANDARDS: Comply with applicable requirements of NCDOT.

SUBMITTALS:

Shop Drawings, Storm Sewer System: Submit shop drawings for the system, including details of underground structures, metal accessories, fittings, and connections, and any variations from those details shown on the drawings.

MATERIAL CERTIFICATES: Provide material certificates signed by the material manufacturer and Contractor for all pipe manhole, catch basins, frames and grates indicating each complies with specifications.

PART 2 - PRODUCTS

CONDUIT MATERIALS:

Polyvinyl Chloride (PVC) Pipe: PVC pipe shall conform to the requirements of ASTM D3034 (SDR35). Joints and fabricated fittings shall be glued hub joints and shall be assembled in accordance with the pipe manufacturer's recommendations and Specification D3212. Minimum cell class shall be 12454B. PVC pipe shall be supplied in 13.0 foot lengths.

Reinforced Concreted Pipe (RCP):

RCP shall be of tongue and groove construction in accordance with ASTM C-76, Class III. All pipe shall be stamped by supplier - "R. C.". Joint material shall be ConSeal CS-102 Butyl Rubber Sealant gasket, or ConSeal CS-202 Butyl Rubber Sealant gasket conforming to ASTM C 990, and Federal Specification SS-S-210.

TRENCH DRAINS:

Provide vehicle traffic grade Trench Drains where indicated. Provide polymer concrete products equal to ACO Drain K100S complete with heavy duty ductile iron gratings locked down with quick locking bolt and bar type lockings as manufactured by ACO Polymer Products.

Provide general purpose grade Trench Drains designed for use in concrete slab applications where indicated. Provide fiberglass channel products equal to ACO Drain FG100 complete with Load Class B, ADA rated, perforated galvanized steel gratings, locked down with quick locking bolt and bar type lockings as manufactured by ACO Polymer Products.

PVC DRAIN BASINS and INLINE DRAINS:

Provide vehicle traffic grade Drain Basins and Inline Drains where indicated shall be PVC with heavy duty ductile iron grates. Products equal to Nyloplast by Advanced Drainage Systems.

CONCRETE MANHOLES:

General: Manholes and Catchbasins shall be precast concrete where indicated. Manholes not of a conventional size may be of concrete block or brick.

Precast Concrete Manholes: Shall comply with ASTM C-478, sized as indicated, with an eccentric cone, precast top, precast bottom and O-Ring joint conforming to ASTM C 493, or RAM-NEK Preformed Plastic Gasket.

Interior diameter of precast manholes shall be based upon pipe size as follows unless otherwise indicated:

<u>Pipe Size</u>	<u>Interior Diameter</u>
Less than 24"	4'
24" - 30"	5'
Larger than 30"	6'

MASONRY MATERIALS:

Concrete Masonry Units (Manhole Block): ASTM C 139.

Manhole Drop Inlet and Catch Basin Brick: ASTM C 32, Grade MS.

Concrete Brick: ASTM C 55, Grade NI.

Masonry Mortar: ASTM C 270, Type M, approximately 1:1 / 4:2 Portland Cement, lime, sand.

Concrete Block: ASTM C 90, Grade NI.

For minor amounts of mortar, packaged materials complying with ASTM C 387, Type M, will be acceptable.

Plasticizing Agent: Omicron or equal. Use in accordance with manufacturer's instructions.

ACCESSORIES:

General: All metal accessories for manholes, catch basins and drop inlets shall be gray cast iron, ASTM A 48, Class 30B. Frames, grates and covers shall be factory coated with an asphalt base paint. Install metal accessories as shown on the drawings.

Rip Rap: Rip rap shall be accomplished in accordance with Section 868 of the N. C. State Highway Specifications for Roads and Structures. Rip rap shall be located and be of the class shown on plans.

Filter Cloth: Filter cloth shall be composed of strong rot proof synthetic fibers formed into a fabric shall be free of any treatment or coating which might significantly alter its physical properties after installation. The filter cloth shall have a puncture strength to withstand a minimum force of 100 lbs., in accordance with ASTM D 751. Filter cloth as manufactured by Monsanto, Carthage Mills, Inc., or approved equal will be acceptable.

Downspout Transition Boots: Downspout transition boot fitting for each downspout shall be a PVC Sewer Solvent Weld Downspout Adaptor, sized for 4"x4" downspout transition to the underground leader pipe size indicated. Provide an SDR 35 fitting, meeting ASTM D-2729, and ASTM D-3034 requirements, utilizing solvent welded connection to SDR 35 PVC pipe leaders. As manufactured or distributed by Ferguson, Genova, NDS or equivalent.

PART 3 - EXECUTION

INSPECTION:

Contractor must examine the areas and conditions under which storm sewer system work is to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

INSTALLATION OF CONDUIT (PIPE):

General:

Perform excavation, trenching, bedding, haunching and backfilling as specified in appropriate Division 2 Sections. Conduct backfill operations of open-cut trenches closely following laying, jointing and bedding of pipe, and after initial inspection and testing are completed.

Pipe bedding, haunching and backfilling shall be in accordance with requirements set forth in Section 02210, TRENCHING AND BACKFILLING FOR UTILITIES.

Inspect conduit before installation to detect any apparent defects. Mark defective materials with white paint and promptly remove from the site.

Particular care shall be taken to prevent damage to pipe and fitting linings and coatings. Pipe shall be protected during handling against impact shocks and free fall.

Lay conduit beginning at the low point of a system, true to the grades and alignment indicated with unbroken continuity of invert. The line and invert grade of each pipe shall be checked from top line carried on batter boards not over 24' apart or by a laser and target.

Cross above or below other pipe a minimum of 6" unless otherwise directed by the Engineer.

Place bell ends of conduit or the groove end of concrete facing upstream.

Bell holes shall be excavated for each joint to assure bedding supports the barrel of the pipe and to facilitate making a perfect joint. Preparatory to making pipe joints, all surfaces of the portion of the pipe to be jointed or of the factory-made jointing materials shall be clean and dry.

Install gaskets in accordance with manufacturer's recommendations for the use of lubricants, cements, and other special installation requirements.

The Contract Documents shall provide for the construction of a Foundation of No. 57 crushed stone in the bottom of trenches when unstable material is encountered. Such unstable material shall be removed to the depth required by the Architect's testing representative and replaced with No.57 stone such that the pipe will be adequately supported throughout the entire length. Excavation below the planned pipe invert elevation as shown on the Approved Plans shall be refilled with No. 57 crushed stone.

Reinforced Concrete Pipe (RCP): Install in accordance with applicable provisions of the American Concrete Pipe Association "Concrete Pipe Field Manual", unless otherwise indicated.

PVC PIPE INSTALLATION:

Flexible thermoplastic sewer pipe shall be installed in accordance with ASTM D2321- 83a, except as modified by these specifications and the specific recommendations of the pipe manufacturer.

Pipe cutting, where permitted, shall be done in accordance with the written recommendations of the pipe manufacturer. Only factory cut ends shall be used for solvent weld joints.

Trenches shall be excavated in straight lines and uniformly sloped between manholes or junction structures. The trench shall be excavated a minimum of six inches (6") below the pipe bottom in order to receive the required bedding of Class I No. 57 crushed stone. Pipe bedding, haunching and backfilling shall be in accordance with requirements set forth in Section 02210, TRENCHING AND BACKFILLING FOR UTILITIES.

Cleaning Conduit: Clear the interior of conduit of dirt and other superfluous material as the work progresses.

Place plugs in the ends of uncompleted conduit at the end of the day or whenever work stops.

Flush lines between manholes as required to remove collected debris.

Interior Inspection: Inspect conduit to determine whether line displacement or other damage has occurred.

A light held in a manhole shall show a full circle of light when viewed from the adjoining end of the line.

Make inspections after lines between manholes, or manhole locations, have been installed and approximately two feet of backfill is in place and at completion of the project.

If the inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, take whatever steps are necessary to correct such defects to the satisfaction of the Engineer.

Connection to Existing Structures: Pipe connections to existing structures shall be made in such manner that the finished work will conform as nearly as practicable to the essential applicable requirements specified for new structures, including all necessary concrete work, cutting, and shaping.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

CHAIN LINK FENCING AND GATES:

Provide chain link fences and gates as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings.

Product Data: Submit manufacturer's technical product data, and installation instructions for metal fencing, fabric, gates and accessories.

Dimensions indicated for pipe, roll-formed, and H-sections are outside dimensions, exclusive of coatings.

Manufacturer: Subject to compliance with requirements, provide products of one of the following:

Galvanized Steel Fencing and Fabric:

Allied Tube and Conduit Corp.

American Fence Corp.

Anchor Fence, Inc.

Galvanized Steel Fencing:

Fabric: No. 9 ga. (0.148") finished size steel wires, 2" mesh, with top selvages knuckled for fabric 60" high and under, and both top and bottom selvages twisted and barbed for fabric over 60" high. Tennis court mesh to be 9 ga. X 1 3/4" mesh.

Furnish one piece fabric widths for fencing up to 12' high.

Fabric finish, galvanized, ASTM A 392, Class I, with not less than 1.2 oz. zinc per sq. ft. of surface.

Framework: Galvanized steel, ASTM A 120 or ASTM A 123, with not less than 1.8 oz. zinc per sq. ft. of surface.

Fittings and Accessories: Galvanized, ASTM A 153, with zinc weights per Table I.

Framing and Accessories:

End, Corner, and Pull Posts: Minimum sizes and weights as follows:

- Up to 6' fabric height, 2.375" od steel pipe, 3.65 lbs. per lin. ft., or 3.5" x 3.5" roll-formed sections, 4.85 lbs. per lin. ft.
- Over 6' fabric height, 2.875" od steel pipe, 5.79 lbs. per lin. ft., or 3.5" roll-formed sections, 4.85 lbs. per lin. ft.

Line Posts: Space 10' o.c. maximum, unless otherwise indicated, of following minimum sizes and weights.

- Up to 6' fabric height, 1.90" od steel pipe, 2.70 lbs. per lin. ft. or 1.875" x 1.625" C sections, 2.28 lbs. per lin. ft.
- Over 6' to 8' fabric height, 2.375" od steel pipe, 3.65 lbs. per lin. ft. or 2.25" x 1.875" H-sections, 2.64" lbs. per lin. ft.
- Over 8' fabric height, 2.875" od steel pipe, 5.79 lbs. per lin. ft. or 2.25" x 1.875" H-sections, 3.26 lbs. per lin. ft.

Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of a double installation, for nominal gate widths as follows:

<u>Leaf Width</u>	<u>Gate Post</u>	<u>lbs. / lin. ft.</u>
• Up to 6'	3.5" x 3.5" roll-formed section or 2.875" od pipe	4.85 5.79
• Over 6' to 13'	4.000" od pipe	9.11
• Over 13' to 18'	6.625" od pipe	18.97
• Over 18'	8.625" od pipe	28.55

Top Rail: Manufacturer's longest lengths, with expansion type couplings, approximately 6" long, for each joint. Provide means for attaching top rail securely to each gate corner, pull and end post.

1.66" od pipe, 2.27 lbs. per ft. or 1.625" x 1.25" roll-formed sections, 1.35 lbs. per ft.

Tension Wire: 7-gage, coated coil spring wire, metal and finish to match fabric.

Locate at bottom of fabric.

Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener.

Post Tops: Provide weathertight closure cap with loop to receive tension wire or top rail; one cap for each post.

Stretcher Bars: One-piece lengths equal to full height of fabric, with minimum cross-section of 3/16" x 3/4". Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into post.

Stretcher Bar Bands: Space not over 15" o.c., to secure stretcher bars to end, corner, pull, and gate posts.

Gates: Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding or with special fittings and rivets for rigid connections, providing security against removal of breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories. Space frame members maximum of 8' apart unless otherwise indicated.

Provide same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretcher bars to gate frame at not more than 15" o.c.

Install diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.

Where barbed wire is indicated above gates, extend end members of gate frames 1'-0" above top member. Provide necessary clips to receive and secure 3 strands of wire.

Swing Gates: Fabricate perimeter frames of minimum 1.90" od pipe.

Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:

- Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180° gate opening. Provide 1-1/2 pair of hinges for each leaf over 6' nominal height.
- Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.

Double Gates: Provide gate stops for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar.

Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.

Sliding Gates: Provide manufacturer's standard heavy-duty inverted channel track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, hardware, and accessories as required.

Wire Ties: For tying fabric to line posts, use wire ties spaced 12" o.c. For tying fabric to rails and braces, use wire ties spaced 24" o.c. For tying fabric to tension wires, use hog rings spaced 24" o.c.

Manufacturer's standard procedure will be accepted if of equal strength and durability.

Concrete: Provide concrete consisting of portland cement, ASTM C 150, aggregates ASTM C 33, and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 3000 psi using at least 4 sacks of cement per cu. yd., 1" minimum size aggregate, maximum 3" slump, and 2% to 4% entrained air.

Excavation: If not shown on drawings, excavate holes to minimum depth and diameter as recommended by fence manufacturer.

Installation: Install in accordance with ASTM F 567 and written installation instructions of fencing manufacturer to provide secure, aligned installation.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

1.1 SECTION INCLUDES

- A. Formwork for cast—in place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

1.2 RELATED SECTIONS

- A. Section 03200 — Concrete Reinforcement.
- B. Section 03300 — Cast-in-Place Concrete.

1.3 REFERENCES

- A. ACI 301 — Structural Concrete for Buildings.
- B. ACI 318 — Building Code Requirements for Reinforced Concrete.
- C. PS 1 — Construction and Industrial Plywood.

1.4 DESIGN REQUIREMENTS

- A. Design and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 and 318.
- B. Maintain one copy of each document on site.

1.6 REGULATORY REQUIREMENTS

- A. Conform to ACI 301 and ACI 318 code for design, fabrication, erection and removal of formwork.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site to prevent damage.
- B. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.8 COORDINATION

- A. Coordinate this Section with other Sections of work which require attachment of components to formwork.
- B. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

PART 2: PRODUCTS

2.1 WOOD FORM MATERIALS

- A. Plywood: Douglas Fir; solid one side, tight faced undamaged sheets with clean, true edges.

2.2 MANUFACTURERS — PREFABRICATED FORMS

- A. Symons or equal.

2.3 PREFABRICATED FORMS

- A. Preformed Steel Forms: Minimum 16 gage, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- B. Steel Tubular Column Type: Round, steel material, minimum 16 gage, surface treated with release agent, of sizes required.

2.4 FORMWORK ACCESSORIES

- A. Form Ties: Snap—off type, galvanized metal, cone type, with waterproofing washer.
- B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture.
- C. Dovetail Anchor Slot: Galvanized steel, 22 gage, foam filled.
- D. Flashing Reglets: Galvanized steel, 22 gage, longest possible lengths, with alignment splines for joints, foam filled,
- E. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- F. Waterstops: Hydrophylic type as manufactured by American Colloid or approved equal.

PART 3: EXECUTION

3.1 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

- A. Hand trim sides and bottom of earth forms. Remove loose soil, mud, and debris prior to placing concrete.

3.3 ERECTION — FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to over stressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval before framing openings in structural members which are not indicated on Drawings.
- F. Provide chamfer strips on exposed external corners.

3.4 APPLICATION — FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items which will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
- D. Position recessed reglets for brick veneer masonry anchors to spacing and intervals noted on drawings or specified in Section 04200.
- E. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- F. Install waterstops in accordance with manufacturer's instruction continuous without displacing reinforcement.
- G. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- H. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean—out ports.

- D. During cold weather, remove ice and snow from within forms. Do not use de—icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.7 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 301.

3.8 FIELD QUALITY CONTROL

- A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

3.9 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall include furnishing all labor and materials required to provide all cast-in-place concrete scheduled on Drawings and as specified in this Section.

Related Work Specified Elsewhere:

Concrete Formwork (Section 03100)
Concrete Reinforcement (Section 03200)
Polished Concrete Floor Finishes (Section 03362)

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Industry Standards Index in Division 1.

LEED NC, U. S. Green Building Council

DELIVERY AND PROTECTION OF MATERIALS:

Store cement in weather tight structure with floor at least 12 inches off ground, and accessible for inspection in original packages.

Store fine and coarse aggregate separately. Segregate sizes and avoid getting dirt and foreign materials in concrete.

Deliver ready-mixed concrete in compliance with requirements set forth in ASTM C 94.

Provide documentation of LEED credits requirements for use of local regional materials.

SEVERE-WEATHER PROVISIONS:

Cold-Weather Concreting: (In accordance with ACI 306 and as follows):

Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather. Do not use frozen materials, or materials containing ice.

All concrete materials and all reinforcement, forms, fillers, and around which concrete is in contact shall be free from frost.

Whenever temperature of surrounding air is below 40 degrees F., all concrete shall have temperature between 70 degrees and 80 degrees F. Provide adequate means for maintaining temperature not less than 70 degrees F. for three days, or 50 degrees F. for five days, or for as much more time as is necessary to insure curing of concrete.

Use no salt or other chemicals to prevent freezing.

Housing, covering, or other protection used in connection with curing shall remain in place, intact, at least 24 hours after artificial heat is discontinued.

Hot Weather Concreting: (In accordance with ACI 305 and as follows):

Provide adequate methods of lowering temperature of concrete ingredients so that temperature of concrete when placed does not exceed 90 degrees F.

When weather is such as to raise concrete temperature, as placed, consistently above 80 degrees F., use approved retarder.

Sprinkle all subgrade and forms with water before placing concrete. Remove all excess water before placing concrete.

Start curing as soon as practicable to prevent evaporation of water and keep forms wet. Protect flat work from dry wind, direct sun, and high temperatures.

PART 2: PRODUCTS

CEMENT:

Cement shall be standard portland cement of United States manufacture, conforming to ASTM C 150, Type I or Type III. Only one brand of commercial portland cement shall be used. Each bag shall weigh approximately 94 pounds and contain one cubic foot.

CONCRETE AGGREGATES:

Fine Aggregate: Washed sand having clean, hard, durable, uncoated grains, free from harmful substances conforming to ASTM C 33.

Coarse Aggregate for standard-weight concrete: crushed stone, gravel, or other approved inert material having clean, hard, durable uncoated particles conforming to ASTM C 33. Maximum size, in accordance with ACI 318.

Lightweight Coarse Aggregate shall conform to ASTM C 330. Lightweight aggregate shall be expanded shale or slate. Maximum size of aggregate shall be of 3/4".

WATER:

Clean and free from harmful amounts of acids, alkalies, or organic materials.

VAPOR BARRIER:

Vapor barrier under floor slabs on earth shall be puncture resistant polyethylene sheet not less than 15 mils thick, with permeance of less than 0.01 perms per ASTM F 1249 or ASTM E 96, and in compliance with ASTM E 1745 Class A and ACI 302. Accessories would include seam tape and vapor proofing mastic with permeance less than 0.03 perms. Provide pipe boots constructed from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

EXPANSION JOINT MATERIALS:

Expansion joint material shall be asphalt-impregnated fiber strips, 1/2" thick, unless otherwise shown or noted: Flexcell by Celotex Corporation, Sealtight by W. R. Meadows, Inc., Joint Filler by Serviced Products Corporation, or approved equal.

ADMIXTURES:

Water Reducing Admixture: ASTM C 494, Type A, and contain no chloride ions.

Air Entraining Admixture: ASTM C 60 for slabs permanently exposed to weather. No air entraining admixture is to be used for concrete not exposed to weather. Air content is to be confirmed by lab tests for both air entrained and non-air entrained mixes.

CLASS OF CONCRETE:

f'c minimum 3000 psi, maximum 150 pcf (regular weight).

f'c minimum 3000 psi, maximum 110 pcf (light weight-for use in elevated slabs).

f'c minimum 3000 psi, maximum 150 pcf (regular weight pea gravel) high slump mix for concrete masonry fill.

MIX DESIGNS:

Contractor shall select a testing laboratory acceptable to Architect to verify mixes of all classes of concrete.

Contractor shall submit samples in adequate quantities for each mix verification, of all concrete materials to be used on project to designated testing laboratory.

Laboratory shall be engaged by and paid by the contractor out of the material testing allowance.

Submit four (4) copies of all mix design, aggregate test results, and compression test results to Architect prior to use on the job.

PLANT MIXING:

Proportioning Concrete:

Stresses for design of this structure are based on specified minimum 28-day compressive strength of concrete. Proportions shall be in compliance with approved design mix for each class of concrete.

Batching:

Ready-mixed concrete shall be mixed and delivered in accordance with requirements of ASTM C 94.

Coordinate with requirements of Section 03362 – Polished Concrete Floor Finishes.

Producer shall furnish delivery ticket with each load of concrete delivered under this Specification. Delivery ticket shall show clearly class and strength of concrete, size of coarse aggregate, slump ordered, and date and time of departure from batching plant.

1. Stresses for design of this structure are based on specified minimum 28-day compressive strength of concrete. Proportions shall be in compliance with approved design mix for each class of concrete.
2. Regular weight 3000 psi concrete shall be proportioned for a slump of 4" + or - 1".
3. Lightweight 3000 psi concrete shall be proportioned for a slump of 6" + or - 1".
4. Fine aggregate 3000 psi concrete masonry grout shall be proportioned for a slump of 8" + or - 1".

5. All concrete shall be proportioned for a maximum water to cement ratio 0.5.
6. Concrete not permanently exposed to weather such as concrete for foundations, interior slabs on grade, concrete unit masonry grout, and elevated slabs on composite metal deck shall not have air added by entrainment admixtures. This requirement shall be verified by the testing laboratory.
7. Concrete to be permanently exposed to weather shall have air added by entrainment admixtures. Air content shall be 5% + or – 1%. This requirement shall be verified by the testing laboratory.

CONVEYING EQUIPMENT:

Carts or buggies transporting concrete more than 50 feet shall be equipped with pneumatic tires.

Equipment for chuting or conveying concrete shall be of sufficient size to insure continuous flow of concrete at delivery and without separation of materials.

PART 3: EXECUTION

EVALUATION OF COMPRESSION TESTS:

Evaluation of results of tests for ultimate-strength design concrete shall be according to ACI 318.

Neither results of laboratory verification tests nor any provision in Contract Documents shall relieve Contractor of obligation to furnish concrete of class and strength specified.

INSPECTION OF WORK BEFORE PLACING:

Inspect work to receive concrete for deficiencies which would prevent proper execution of finished work. Do not proceed with placing until such deficiencies are corrected.

Do not place concrete on earth until fill or excavation has been prepared as set forth under applicable sections of specifications for that work as verified by the testing lab.

Before any concrete is placed in form, all pipes or sleeves, openings, or embedded items shall be in place and shall receive all tests specified for them.

Remove all grease, oil, mud or other foreign matter from forms and have reinforcing steel in proper condition and position before placement of concrete. Dowels shall be in place and tied off prior to placing concrete.

Remove hardened, or partially hardened, concrete on forms or reinforcement before placing concrete.

CONVEYING:

Convey concrete from mixer to placement by methods which will prevent separation or loss of material. No water shall be added at the site to aid placement of concrete. Concrete too stiff to be properly placed shall be rejected and removed from the site and legally disposed of at no additional cost to the owner.

Runway supports shall not bear upon reinforcing steel or fresh concrete.

If pump(s) are used for conveying concrete, there shall be no aluminum in contact with the concrete, either in pump or in conveying pipes.

Clean conveying equipment thoroughly before run of concrete at frequent intervals.

CONSTRUCTION AND EXPANSION JOINTS:

Construction Joints: Early in construction program, contractor shall review with Architect construction joints he proposes to use, not indicated on the Drawings. Contractor shall not use any construction joints not approved by Architect.

Expansion Joints: Install as indicated.

PLACING:

Deposit concrete as nearly as practicable in its final position to avoid rehandling. Do not deposit concrete on work partially hardened or contaminated by foreign material. Do not use retempered concrete. In no case use concrete when elapsed time, after addition of water and cement to batch, exceeds one hour.

Concrete shall not be dropped more than four feet. For dropping greater distances use metal chutes or tremie pipes.

Once concreting is started carry on as continuous operation until placing of section is completed. Finish top surface to true plane. When construction joints are necessary, they shall be made in accordance with article above. Do not allow cold joints to occur within pours.

Compact all concrete thoroughly by suitable means during placing, and work thoroughly around reinforcement, embedded fixtures, and into corners of forms. When vibrator is used, apply directly to concrete. Do not over vibrate.

PROTECTION

During curing period protect concrete from damaging mechanical disturbances, particularly load stresses, heavy stock, and excessive vibration. Protect all finished concrete surfaces from damage by construction equipment, materials, or methods, and by rain, running water, hot sun, or windy conditions. Do not load self supporting structures in such a way as to overstress concrete.

Coordinate with protection requirements of Section 03362 – Polished Concrete Floor Finishes.

TESTING:

Conduct strength tests of concrete in accordance with following procedures:

Secure composite samples in accordance with "Method of Sampling Fresh Concrete" (ASTM C 172).

Mold and cure five specimens from each sample in accordance with "Method of Making and Curing Concrete Compression and Flexure Specimens in the Field" (ASTM C 31). Five specimen comprise one test.

Test Two Specimens at 7 days (ASTM C 39). Test two specimens at 28 days in accordance with "Method of Test for Compressive Strength of Molded Concrete Cylinders" (ASTM C 39). Test evaluation shall be conducted in accordance with provisions of ACI 318. Keep one Specimen in reserve.

Make one strength test for each 100 cu. yds. or fraction thereof for each mix design of concrete placed in any one day, except that in no case shall given mix design be represented by less than five tests.

Testing Laboratory shall be selected and paid by the Contractor out of the material testing allowance.

Report all test results to Architect, Structural Engineer, and Contractor on same day that tests are made.

Testing laboratory shall make and handle all test cylinders.

NON-CONFORMING MATERIAL

Any tested concrete material that fails to meet design strength at 28 days shall be removed and repoured. Substandard concrete may be allowed to remain if certified structurally adequate by a qualified independent engineer and approved by the Owner and Architect, however, the cost of the substandard material shall be deducted from the contract sum.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work shall consist of providing specified finishes to all cast-in-place concrete shown on drawings.

RELATED WORK:

Division 3 Specifications

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Industry Standards Index in Division 1.

SUBMITTALS:

Submit (in duplicate) Manufacturer's printed instructions for application of curing compounds and floor hardeners.

PART 2: PRODUCTS

FINE AGGREGATE: ASTM C 33, fine aggregate. Natural sand

PORTLAND CEMENT: ASTM C 150, Type 1, gray.

WATER:

Potable, and free of chemicals affecting set of cement.

CURING COMPOUND AND SEALER:

Transparent, resinous sealer, in volatile, conforming to ASTM C 309.

LIQUID CHEMICAL FLOOR HARDENER:

Colorless, aqueous solution containing blend of magnesium fluosilicate and zinc fluosilicate with wetting agent, containing not less than 2 lbs. fluosilicates per gallon. Compound shall be approved by Architect in writing.

ABRASIVE AGGREGATE:

Ceramically bonded aluminum oxide grains 1/8" to 1/32" size. Material shall be delivered to the site in the manufacturer's original container. Submit sample and manufacturer's descriptive data for approval.

JOINT SEALANTS:

Apply interior and exterior joint sealant products required by drawings at locations indicated on drawings.

PROTECTION:

Coordinate with protection requirements specified in Section 03362 – Polished Concrete Floor Finishes.

PART 3: EXECUTION

PATCHING CONCRETE:

Concrete which is not formed as shown on Drawings, or is out of alignment or level, or shows defective surface, or shows defects which reduce structural strength of member or members, shall be considered as not conforming to intent of these specifications and shall be removed from job by Contractor at his expense, unless Architect grants permission to patch effective area. Permission to patch any such area shall not be considered a waiver of Architect's right to require complete removal of defective work if patching does not, in his opinion, satisfactorily restore quality and appearance of surface, or if patching does not restore structural strength of member or members.

After removing forms, inspect all concrete surfaces. Patch any pour joints, voids, honeycomb, stone pockets, or other defective areas permitted by Architect to be patched, and all tie holes. Where necessary, chip away defective areas to depth of not less than 1", with edges perpendicular to surface. Wet area to be patched and space at least 6" wide entirely surrounding it to prevent absorption of water from patching mortar. Brush grout of equal parts portland cement and sand (with sufficient water to produce brushing consistency) into surface, followed immediately by patching mortar. Patching mortar shall be made of same material (and of approximately same proportions) as used for concrete except that coarse aggregate shall be omitted. Mortar shall not be richer than 1 part cement to 3 parts sand. Amount of mixing water shall be as little as is consistent with requirements of handling and placing. Mortar shall be retempered without addition of water by allowing it to stand for period of one hour, during which time it shall be mixed occasionally with trowel to prevent setting.

Compact mortar thoroughly into place and screed off to leave patch slightly higher than surrounding surface. Leave patch undisturbed for period of 1 to 2 hours to permit initial shrinkage before beginning final finishing. Finish patch in manner to match adjoining surface. On exposed surface where unlined forms have been used, obtain final finish by striking off surface with straight-edge spanning patch, held parallel to direction of form marks. All patches shall be used in accordance with curing requirements for surface in which patch occurs. Keep patch moist for not less than 3 days after installation.

Tie-holes left by withdrawal of rods, or holes, left by removal of ends of ties shall be filled solidly with mortar after first being wet thoroughly. Any excess mortar at surface of wall shall be struck off flush with cloth.

FLATNESS AND LEVELNESS:

Comply with ACI Standard No. 117 and provide floors with a flatness of F25 and a levelness of F20. Use laser guided equipment to set all forms. Use laser guided highway screed to achieve specified levelness and flatness. Use of BULLFLOATS is prohibited.

Areas of Integrally Colored and Dye Stained Polished Concrete Floor Finishes: Comply with ACI Standard No. 117 and provide floors with a flatness of minimum F50 and a minimum levelness of F30. Use laser guided equipment to set all forms. Use laser guided highway screed to achieve specified levelness and flatness. Use of BULLFLOATS is prohibited.

TESTING:

Floors shall be tested for levelness and flatness by an independent testing agency, using a "Dipstick Floor Profiler". Floors that do not meet specification will be removed and re-constructed.

MONOLITHIC CEMENT FINISH:

Apply steel trowel finish to surface of concrete roof and floor slabs as follows:

- For all floors where, in Finish Schedule, resilient flooring or carpet covering is called for.
- For all roof slab areas (for future use as floor).
- For all other concrete floors, stairs, platforms, or slabs where, in Finish Schedule, or shown on Drawings, exposed concrete finish is called for, unless otherwise noted.

Screed floor slabs to an even surface by use of straight-edge and screeding strips accurately to proper grade. Float concrete with laser guided highway screed in manner which will compact and produce surface free from depressions or unevenness. Floors shall be level and flat within tolerances and guidelines specified, except where drains occur (in which cases floors shall be pitched to drains). Steel trowel concrete after concrete has hardened sufficiently to prevent fine materials from working to top, and only after all water sheen has disappeared. Drying of surface moisture before troweling shall proceed naturally, and shall not be hastened by dusting on of dry sand or cement. Perform final troweling after concrete has hardened so that no mortar accumulates on trowel and ringing sound is produced as trowel is drawn over surface.

Coordinate with requirements and work specified in Specification Section 03362 - Polished Concrete Floor Finishes.

Exterior Concreted Areas:

Provide all (walks and vertical surfaces) surfaces with a unidirectional fine broom finish, with concrete walk 1/2" tooled expansion joints at 30' centers maximum and sawcut joints at 5' centers maximum. Pour sample for Architect approval.

CURING:

General Requirements for Curing:

Prevent surfaces of concrete from drying out until required curing time has elapsed. Start curing procedures immediately following initial set of concrete.

Surfaces to Receive Finishes Set in Portland Cement Setting Beds:

Cover with non-staining, reinforced kraft paper. Lap kraft paper, and keep weighted down to prevent evaporation. Do not use membrane curing compound on these surfaces.

FLOOR HARDENER:

Apply to floor surfaces to be exposed in accordance with Manufacturer's printed instructions, and at a rate of not less than 100 sq. ft. per gallon. Apply uniform coating to avoid mottled appearance.

GRAY GLOSS URETHANE FLOOR SEALER FOR EQUIPMENT PLATFORMS, BOILER ROOMS, MECHANICAL ROOMS, ELECTRICAL ROOMS, CUSTODIAL ROOMS: (Apply whether scheduled or not; typical)

After all areas are final cleaned, to include removal of all stains and exposed reinforcing fibers, apply Rexthane gray gloss urethane to floor surfaces to be exposed (no floor finishes except sealer) in accordance with Manufacturer's printed instructions, and at a rate of not less than manufacture's

application rate instructions and to achieve a permanent high gloss sheen. Apply uniform coating to avoid mottled appearance. Coordinate with Section 09900 requirements.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

1.1 SECTION INCLUDES

- A. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

1.2 REFERENCES

- A. ACI 301 - Structural Concrete for Buildings.
- B. ACI 318 - Building Code Requirements For Reinforced Concrete.
- C. ACI SP-66 - American Concrete Institute - Detailing Manual.
- D. ANSI/ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.
- E. ANSI/ASTM A184 - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
- F. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- G. ANSI/ASTM A496 - Deformed Steel Wire Fabric for Concrete Reinforcement.
- H. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
- I. ANSI/AWS D1.4 - Structural Welding Code for Reinforcing Steel.
- J. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- K. ASTM A616 - Rail Steel Deformed and Plain Bars for Concrete Reinforcement.
- L. ASTM A617 - Axle Steel Deformed and Plain Bars for Concrete Reinforcement.
- M. ASTM A704 - Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
- N. ASTM A706 - Low-Alloy Steel Deformed Bars for Concrete Reinforcement.
- O. ASTM A767 - Zinc-Coated (Galvanized) Bars for Concrete Reinforcement.
- P. ASTM A775 - Epoxy-Coated Reinforcing Steel Bars.
- Q. ASTM D3963 - Epoxy-Coated Reinforcing Steel.
- S. AWS D12.1 - Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.
- T. CRSI - Concrete Reinforcing Steel Institute - Manual of Practice.
- U. CRSI 63 - Recommended Practice For Placing Reinforcing Bars.
- V. CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.
- B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- C. Submit in writing any request for deviation from the design drawings and specifications.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with CRSI 63, 65 and Manual of Practice, ACI 301, ACI SP-66, ACI 318, ANSI/ASTM A184.
- B. Submit certified copies of mill test report of reinforcement materials analysis.

1.5 COORDINATION

- A. Coordinate with placement of formwork, formed openings and other Work.

PART 2: PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, unfinished.
- B. Welded Steel Wire Fabric: ASTM A185 Plain Type; in flat sheets; unfinished. Rolled WWF shall not be acceptable for use on this job.

2.2 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.
- C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Stainless steel type; size and shape as required.

2.3 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice ACI SP-66, ACI 318 ANSI/ASTM A184.
- B. Locate reinforcing splices not indicated on drawings, at point of minimum stress. Indicate location of splices on shop drawings for approval by the Architect/Engineer.

PART 3: EXECUTION

3.1 HANDLING AND STORAGE

- A. Provide proper equipment for safe off loading and handling of material.

- B. Provide proper clean level storage area with proper skids to keep material clear of mud and water.
- C. Keep material free from mud and other deleterious materials that will reduce bond and do not place any reinforcing bars that are bent, twisted, broken, pitted, or otherwise unsuitable for use on the project as determined by the architect.
- D. All necessary field bending and straightening shall be accomplished without heating the material.
- E. Cutting torch shall be used only for cut off of material but not for bending. All heat bent material will be rejected by the inspector and shall be promptly removed and replaced at no additional cost. Do not weld reinforcing bars.

3.2 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position. WWF laying on the metal deck and being manually pulled up into the fresh concrete during concrete placement operations shall not be acceptable.
- B. Do not displace or damage vapor barriers. Damaged vapor barrier shall be removed and replaced at the direction of the Architect.
- C. Accommodate placement of formed openings.
- D. Maintain concrete cover around reinforcing as indicated on drawings.
- E. Provide proper and adequate supports at maximum 3 ft x 3 ft spacing each way for support of wwf in the designated position. Tie off wwf sheets so that placement of the fresh concrete will not cause the wwf to be displaced. Pulling up of the wwf sheets into freshly placed concrete will not be an acceptable means of placing the wwf.

3.3 FIELD QUALITY CONTROL

- A. Field inspection will be performed by the Architect.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1 GENERAL:

1.01 DESCRIPTION OF WORK:

- A. Furnish And Install All Architectural Precast Concrete Units (White). To include but not limited to precast benches, column caps, wall caps, and window sills.
- B. Related Work Specified Elsewhere
 - a. Division 3 Specifications
 - b. Division 9 Specifications

1.02 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

- A. American Concrete Institute (ACI) Publications:
 - 1. 211.1-81 Standard practice for selecting proportions for concrete.
 - 2. 214-77 (R83) Recommended practice for evaluation of strength test results of concrete.
 - 3. 301-84 Specifications for structural concrete for buildings.
 - 4. 304-73 Recommended practice for measuring, mixing, transporting, and placing concrete.
 - 5. 305r-82 Hot weather concreting.
 - 6. 306r-78 Cold weather concreting.
- B. American Society for Testing Materials (ASTM) Publications:
 - 1. A 36-81a Structural steel.
 - 2. A 185-79 Welded steel wire fabric for concrete reinforcement.
 - 3. A 283-81 Low and intermediate tensile strength carbon steel plates, shapes, and bars.
 - 4. A 615-82 Deformed and plain billet-steel bars for concrete reinforcement.
 - 5. C 31-84 Making and curing concrete test specimens in the field.
 - 6. C 33-84 Concrete aggregates.
 - 7. C 39-83b Compressive strength of cylindrical concrete specimens.
 - 8. C 94 Concrete batch plant, mixer, mixing and measuring.
 - 9. C 150-84 Portland cement.
- C. Prestressed Concrete Institute (PCI) and Architectural Precast Association (APA) Publications:
 - 1. MNL 117-77 Manual for quality control for plants and production of Architectural Precast Concrete products.
 - 2. 2nd edition Architectural Precast Concrete

1.03. SUBMITTALS:

- A. Shop drawings and descriptive data: Before manufacture of A.P.C. units, submit and obtain approval for shop drawings and descriptive data including the following:
 - 1. Layout, dimensions, cross sections, and edge details, location and type of reinforcement including reinforcement for safe handling.
 - 2. Design calculations showing compliance with indicated loading conditions.
 - 3. Setting drawings for A.P.C. units and anchors.

- B. Manufacturer's Mix Design:
 - 1. Submit a mix design for the Architectural Precast Concrete including a complete list of materials with brand names and sources.
 - 2. Provide test reports indicating that mix has been tested to meet properties specified.
 - 3. Obtain approval before proceeding with manufacture.
- C. Catalog Data:
 - 1. Architectural Precast Concrete producer's literature and company information.
 - 2. Plant certification information
 - 3. Anchorage information.
 - 4. Joint sealant information
- D. Samples: Samples to be submitted as follows:
 - 1. Submit Architectural Precast Concrete samples to illustrate quality, color and finish.
 - 2. Smooth form finish
 - 3. Colors to match available standard White colors of Cast Stone Systems, Inc.

1.04.1 DELIVERY AND STORAGE:

- A. Deliver Architectural Precast Concrete units on supports designed for the protection of these units, or packed and wrapped on pallets for job site storage.

PART 2 PRODUCTS

2.01 CONCRETE:

- A. Manufacturer's Mix Design:
 - 1. Concrete shall have a 28 day compressive strength of 5,000 PSI and a 4 to 6 percent of water absorption.
- B. Concrete Mix Materials:
 - 1. Provide aggregates, sand, mineral pigments, Admixtures and White Portland Cement to produce concrete with the specified properties and capable of obtaining the approved color and smooth form finish.
- C. Backing Mix:
 - 1. Back up mix not allowed, cast units solidly with one concrete mix.

2.02 MATERIALS:

- A. Aggregates:
 - 1. Aggregates shall be natural white stone particles to match the smooth - acid etched finish sample on file.
- B. Cement:
 - 1. White Portland Cement,
 - 2. ASTM C 150-84,
 - 3. Type I or II
- C. Admixtures:
 - 1. ASTM C 494.
 - 2. Calcium chloride shall not be used.
- D. Water: Potable
- E. Reinforcement:

1. Reinforcement bars:
 - a. ACI 301.
 - b. Galvanized after fabrication.
 2. Welded wire fabric:
 - a. ASTM A 185 OR ASTM A 497. Galvanized.
- F. Threaded type concrete inserts:
1. ASTM A 47 OR ASTM A 27. Plated or Galvanized.
- G. Weld plate anchors:
1. ASTM A 36 Steel. shop painted.
- H. Flashing reglets:
1. Galvanized sheet metal.
- I.. Clip angles:
1. ASTM A 36 Steel. Shop painted.
- J. Dowels:
1. ASTM A 36 Steel. Galvanized.

2.03 UNIT FABRICATION:

- A. Size Requirements: (SEE DRAWINGS)
1. Window sill units shall be 60 inches long, with a minimum length of 48 inches long.
- B. Formwork and fabrication tolerances:
1. Provide metal, concrete, wood or rubber forms, designed and built to resist deformation.
 2. Provide dimensional tolerances as follows:
 - a. Overall unit dimensions - plus/minus 1/8 inch.
 - b. Cross sectional dimension – plus/minus 3/16 inch.
 - c. Deviation from square – not to exceed 1/8 inch.
 - d. Anchor location – plus/minus 1 inch.
- C. Reinforcement:
1. ACI 301. Properly place, locate, and secure reinforcing bars and welded wire mesh.
- D. Concrete mixing and measurement:
1. ASTM C 94.
- E. Concrete placement:
1. ACI 303 AND MNL 117-77.
 2. Deposit concrete continuously into forms to prevent formation of planes of weakness in units.
 3. Place concrete within a temperature range between 50 and 90 degrees f.
 4. Consolidate concrete to prevent segregation and to produce a dense concrete, free of honey combs.
 5. Units shall be made by the “wet pour” process.
 6. The “dry tamp” method will not be accepted.
- F. Identification markings:
1. Mark each unit to correlate with approved shop/setting drawings.
 2. Do not locate markings on finished surfaces.
- G. Exposed to view finished surfaces:

1. Smooth - acid etched finish on all finished faces.
- H. Concealed surfaces:
 1. Provide a form or troweled surface.
- I. Curing:
 1. Maintain units in a damp environment until concrete attained 60% of design strength.
- J. Manufacturer:
 1. Producer to be Cast Stone Systems, Inc. or an approved equal fabricator.
 2. Manufacturing facility is to be a "certified plant" under the Certification programs of the Architectural Precast Association (APA) or the Prestressed Concrete Institute (PCI).

PART 3 – EXECUTION

- 3.01 **Installation:** Install Architectural Precast Concrete units in accordance with approved shop drawings and descriptive data, and as specified below:
- A. Building framing system:
 1. Allow for adjustment to compensate for sagging in the structural steel members as the architectural precast concrete units are erected.
 - B. Placing units:
 1. Provide temporary supports and bracing as required to maintain unit position and alignment during attachment to the building.
 2. Properly weld/bolt all connections after units are positioned.
 - C. Erection tolerances:
 1. Locate units to accommodate adjacent materials, proper joint width, and alignment with adjacent.
 2. Units dimensional tolerances are:
 - a. Joints width – not exceed 1/4 inch maximum.
 - b. Unit alignment- +/- 1/4 inch
 - D. Joints:
 1. Joint sealants specified under section 07900 Joint Sealers.
 2. Maximum joint width not to exceed 1/4 inch
 - E. Protection:
 1. Protect exposed surfaces from staining and construction damage.
 2. Extra care shall be taken to avoid damage and staining from tar used in the roofing operation.
 - F. Cleaning:
 1. Thoroughly clean all Architectural Precast Concrete units after installation.
 2. Use detergent, SUR-clean, and ample water, using a brush to scrub clean.
 - G. Sealing:
 1. Seal all exposed surfaces with clear liquid sealer products per manufacturer's directions, as specified in 09900 Paint.

PART 4 – QUALITY CONTROL:

- 4.01 **Product Quality:**

- A. Provide a quality control program as mandated under the Plant certification programs of either the APA or PCI.
- B. Rejection: Units may be rejected for the following deficiencies:
 - 1. Nonconformance to minimum size requirements.
 - 2. Nonconformance to joint width requirements.
 - 3. Nonconformance to specified tolerances.
 - 4. Damage incurred during construction.
 - 5. Ragged or irregular edges.
 - 6. Honeycombs/voids on finished surfaces.
 - 7. Excessive variation in color or finish from approved sample, or unit to unit.
 - 8. Form lines or irregular surfaces.
 - 9. Visible repairs or cracks.
 - 10. Surface crazing.
 - 11. Defective sealer coat.
 - 12. Unacceptable workmanship.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION:

Work Included: The work required under this Section includes furnishing all labor, equipment, materials, and services necessary to complete the brick and masonry block work indicated on the Drawings, or specified herein.

QUALITY ASSURANCE:

Qualifications of Workmen: The masonry work shall be accomplished by experienced masons under the direct supervision of a journey man mason.

Codes and Standards: In addition to complying with all pertinent codes and regulations, material and workmanship shall comply with standards of the National Concrete Masonry Association and the Structural Clay Products Institute.

SUBMITTALS:

Samples: Within thirty (30) days after award of Contract, and before any brick or unit masonry materials are delivered to the job site, submit samples as required of the proposed brick and concrete masonry units to the Architect for his approval.

Certification: Prior to delivery of concrete unit masonry to the job site, deliver to the Architect a letter from the manufacturer of the concrete masonry units certifying that all such concrete masonry units delivered to the job site are in strict conformance with the provisions of this Section of these Specifications.

Sample Panels: Before the masonry work is started, approved sample panels approximately 5 feet long by 4 feet high and of the proper thickness shall be constructed at the job site, reviewed and approved by the Architect. One face shall show the workmanship, coursing, bond, mortar joint thickness, tooling of joints, and range of brick color and texture, all to be as specified or selected by the Architect/Engineer. Sample panel shall duplicate the wall assembly construction with the thru-wall flashing and weep system, and a window opening with frame/sill/flashing weep assembly. The finished work shall match the approved sample panel. Mock up to be maintained throughout construction for workmanship reference.

PRODUCT HANDLING:

Protection: Use all means necessary to protect brick and concrete masonry materials before, during, and after installation and to protect the installed work and materials of all other trades. Cover masonry blocks and brick to prevent excessive moisture absorption.

Portland Cement, lime, and/or pre-packaged mortar mixes shall be delivered to the site and stored in unbroken bags or other approved containers. These materials shall be stored in dry, weather tight sheds or enclosures with elevated floors, which will prevent the inclusion of foreign materials and damage by water or dampness. Masonry sand shall be delivered and stored in a manner to prevent inclusion of foreign material. Brick shall be delivered and stored on the job site on platforms or timbers, clear of the ground. Brick which are chipped, cracked, broken, or marred in other manner shall not be used where exposed to view.

PART 2: PRODUCTS

CONCRETE MASONRY UNITS:

General: All concrete masonry units shall be of sizes shown on Drawings, two-cell type, in gray or neutral color, and conforming with the current ASTM C-90 Standard Specification for Load Bearing Concrete Masonry Units. Provide units with bullnosed exterior corners at all exposed areas.

Standard Grey CMU:

Size: As indicated in the drawings

Color: Standard Color and Texture.

Minimum Net Area Average Compressive Strength: Average of three units 1900 PSI, no individual unit less than 1700 PSI.

Maximum Absorption: Absorption is less than 18 lbs/CF.

Weight Classification: Units shall be lightweight, blended with expanded shale, clay or slate, produced by the rotary kiln process and shall comply with ASTM C331 and ASTM C33 and shall be graded to assure consistent texture.

All units shall be free of organic impurities that will cause rusting, staining, or pop outs and shall contain no combustible material. All lightweight material to be manufactured by rotary kiln process. The use of coal burning power plants residue aggregate (bottom ash) or similar waste products will not be allowed.

The producer of the lightweight concrete masonry units shall furnish a letter of certification stating that all lightweight aggregate used in the manufacture of the units was expanded shale, clay or slate produced by the rotary kiln process, Big River industries or approved equal conforming to ASTM C331 and ASTM C33.

Acceptable Manufacturers:

Adams Products Company - Oldcastle, Johnson Concrete Company or approved equal. Manufacturer other than approved listed shall provide submittal samples and received written approval by the Architect prior to bid.

ARCHITECTURAL CMU:

Where indicated on Drawings, provide concrete masonry units, two-cell type, in gray or neutral color, with an architectural finish conforming to the current ASTM Spec C-90.

All architectural Concrete Masonry Units shall contain manufacturer-approved integral water repellent CMU admixture at the time of manufacture.

Size: As indicated in the drawings

Color: As Selected from Approved Manufacturers Standard Colors

Minimum Net Average Compressive Strength: High Strength Unit. Average of three units 3000psi, individual unit 2700 psi. Exceeds ASTM C90 Standard Specification.

Maximum Absorption: Low Absorption unit. The unit shall contain specific amounts of the integral water repellent compound so the absorption is less than (7.5%) and/or 10 lbs/CF. Exceeds ASTM C 90 Standard Specification.

Weight Classification: High Density unit. Normal Weight not less than 125lbs/CF.

Exposed Face Finishes: Profile Split Face, Profile Smooth Face, Profile Split Ribbed, Ground Face, Polished Face.

All units shall be free of organic impurities that will cause rusting, staining, or pop outs and shall contain no combustible material. The use of coal burning power plants residue aggregate (bottom ash) or similar waste products will not be allowed.

Acceptable Manufacturers:

Adams Products Company - Oldcastle, Johnson Concrete Company or approved equal. Manufacturer other than approved listed shall provide submittal samples and received written approval by the architect prior to bid.

BRICK: (MATCH EXISTING BRICKS AND EXISTING PATTERNS)

Common brick to be modular size, nominal 2 1/4" x 4" x 8", and shall conform to ASTM C-62, grade MW, use below grade and where not exposed.

Face brick shall be through body wire-cut, modular size nominal 2 1/4" x 4" x 8", and conform to ASTM C-69, grade SW, use for all exposed brick, unless otherwise noted. Provide all brick types, sizes shapes, and colors in patterns as scheduled and indicated on Drawings. MATCH EXISTING BRICKS AND PATTERNS.

MORTAR:

General: Cementitious materials and aggregates shall be handled and stored in such a manner as to prevent deterioration or intrusion of foreign materials. Each material shall be of like brand; all sand shall be supplied from a single source; sand color to be approved by Architect.

Cement: Shall be Portland Cement, Type I or II, meeting Standard Specifications for Portland Cement (ASTM C-150).

Sand: Shall be clean, washed, and meet the requirements of Standard Specification for Aggregate or Masonry Mortar (ASTM C-144-76), with the gradation to satisfy paragraph 3, Grading, and with the omission of subparagraph 3.4.

Hydrated Lime: Shall meet the requirements of the Standard Specification for Hydrated Lime for Masonry Purposes (ASTM C-207), Type S.

Hydraulic Hydrated Lime: Shall meet the requirements of the Standard Specification for Hydraulic Hydrated Lime for Structural Purposes (ASTM C-141).

Color: Provide tinted mortar to match existing brick mortar colors.

Water: Shall be potable.

Admixture-workability and air entraining admixtures may be utilized and shall conform to ASTM C-260.

Portland Cement: ASTM C-10, or Fed. Spec. SS-C-192, Type I, II, or III.

Aggregates: ASTM C-144, aggregate for masonry mortar.

Water: Shall be clean and free of deleterious amounts of acids, alkalies, or organic materials.

Plasticizing Agent: Shall be OMICRON by Master Builders, "Hydrocide Powder", by Sonneborn Bldg. Products, Inc., Subsidiary of DeSoto, Inc., "Hydrolox 400" by Chem-Masters Corp., or approved equal, and used in accordance with mfgs. instructions.

Anti-Freeze Compounds: No anti-freeze liquid, salt, accelerating admixture for masonry mortar or other substance shall be in the mortar to lower the freezing point of the mixing water or accelerate the set of the cement.

Prepackaged Mortar Mixes: Prepackaged mortar mixes may be used with the prior approval of the Architect. The mortar mix shall be in accordance with the following specifications.

Type S Mortar Mix: The mortar mix shall have a compressive strength of 1800 psi minimum at 28 days when tested in accordance with ASTM C-270.

The mortar mix shall contain Portland Cement, hydrated lime, plasticizing admixtures, and/or hydraulic hydrated lime. Mortar mixes which contain other materials, including ground limestone ground slag or other cementitious and non-cementitious materials, are not acceptable.

Bag Label: Each bag of mortar mix shall have a printed label thereon which shall show the contents. Contents shall be described by the percent by volume of Portland Cement (ASTM C-150).

Hydrated Lime (ASTM C-207), Hydraulic Hydrated Lime (ASTM C-141), and Admixtures (ASTM C-260).

Instructions for mixing the mortar mix shall be clearly printed on the container. These instructions shall be by volumetric measurement and shall be limited to the method of mixing in proper proportions of washed sand to 1 bag of the prepackaged mortar mix with water to produce a flow of the proper consistency.

The mortar mix shall be composed only of Portland Cement, Hydrated lime and/or Hydraulic Hydrated Lime and workability admixtures within the following limits:

- a. Maximum of 65% Portland Cement.
- b. Minimum of 33% Hydrated Lime and/or Hydraulic Hydrated Lime.
- c. Maximum of 2% Admixtures.

Air Content: The air content of the pre-packaged mortar mix shall be limited to 16% maximum when tested in accordance with ASTM C-91, Paragraphs 18 through 22.

Autoclave Expansion: Autoclave expansion of the mortar mix shall not exceed 1.0% when determined in accordance with ASTM Method C-151.

On-The-Job Mortar Mix:

Type S. Mortar shall have a compressive strength of 1800 psi minimum at 28 days. The mortar shall be proportioned within the following volumetric limits:

- a. 1 part Portland Cement
- b. 1/2 part Hydrated Lime
- c. Not less than 2 1/4 and not more than 3 times the sum of the volumes of cement and lime used of washed sand measured in a damp, loose condition.

- d. Plasticized per instructions of the mfr., the quantity of which is not to exceed 2% by volume of the cement and lime combination.

Measurement and Mixing:

The method of measuring materials shall be by volume and shall be such that the specified proportions of the mortar materials can be controlled and accurately maintained. A measuring device to make consistent volume measurements shall be used throughout the project. Measurement of washed sand by shovel shall not be permitted.

Mortar Mixer shall be a paddle-type mechanical mixer. It shall be of such design and size to accommodate the mix without overloading, and be adequately powered to vigorously mix the ingredients.

The mortar mixer shall be charged in this order: Add approximately one-half the water required, one-half the washed sand, the cement and lime or prepackaged mortar mix), the remaining amount of washed sand, and then sufficient water to bring the mix to desired consistency. Mortar shall be mixed for a minimum of five minutes after all materials have been charged into the mixer with all batches being mixed to the same consistency.

Mortars that have stiffened because of evaporation of water from the mortar may be retempered by adding water as frequently as needed to restore the required consistency. Mortars shall be used and placed in their final position within 2 hours after mixing. When the temperature is over 80 degrees F., the mortar shall be used within 1 1/2 hours after mixing. Mortar not used within these time periods shall be discarded.

HORIZONTAL JOINT REINFORCEMENT STEEL:

Standards:

Joint Reinforcement for CMU/Brick Veneer Cavity Wall: Truss type in CMU backup wall with hook and key eye; steel wire, hot dip galvanized to ASTM A 153 after fabrication, cold drawn steel wire conforming to ASTM A82, 3/16 inch side rods with No.9 diagonal ties. Backup wall reinforcing shall be units no more than two (2) inches smaller in width than the wall thickness and shall be of deformed rods 3/16" side rods and 9 gage diagonal cross rods all galvanized. Veneer anchored with 3/16" keys and hooks, keys are 4-point flush-welded to backup wall rods. Total unit width shall be no more than two (2) inches smaller in width than the total wall thickness. Hooks shall be extended into veneer wythe 1" from exterior face. Provide Hohmann & Barnard LOX-ALL Adjusto-Flex-Mesh #AF-H Truss, Wire-Bond Series 700 adjustable tab, Dur-O-Eye by Dayton Superior or approved equivalent products.

Interior CMU wall reinforcing shall be Truss Type, as mfgd. by AA Wire Products Co., "DUR-O-WALL", Hohmann & Barnard "LOX-ALL", or other approved equal products. Provide prefabricated corners and intersections. Manufactured in accordance with Uniform Building Code Standard UBC 21-10, ASTM A951, ASTM A580 – Type 304, ACI 530/ASCE 5/TMS402 Building Code Requirements for Masonry Structures.

Reinforcing shall be units no more than two (2) inches smaller in width than the wall thickness and shall be of deformed rods 3/16" side rods and 9 gage diagonal cross rods all galvanized.

Provide galvanized hardware cloth and prefabricated Tees and Corners at all wall intersections.

Interior block partitions shall be reinforced similar to exterior walls.

Spacing: Reinforcing for exterior and interior walls shall be 16" o.c. vertically beginning at the finish floor line and provide line of reinforcing one block course and one below all window heads and sills. Extend 16" beyond jambs on each side.

Lap all splices one full panel of reinforcing unit.

WALL TIES TO STRUCTURAL STEEL:

All exterior and interior masonry walls shall be tied to contiguous steel columns and beams with two piece adjustable tie units such as Heckmann 12 gage 315-D, Hohmann and Barnard 12 gage DW-10HS, or 12 gage Wire-Bond Type III anchors with 3/16 diameter triangular wire ties or approved equal.

Space wall ties to columns and beams at 16" oc maximum. Tie anchors shall be welded to structural steel with 4 fillet welds 1/8" x 3/4".

WALL TIES TO LIGHT GAGE METAL WALL STUDS

All exterior masonry veneer with metal stud back up shall be tied to metal studs with two piece adjustable tie units such as Heckmann 12 gage 315-D, Hohmann and Barnard 12 gage DW-10HS, or 12 gage Wire-Bond Type III anchors with 3/16 diameter triangular wire ties or approved equal.

Space wall ties so that no tie is required to tie more than 2 2/3 square feet of masonry veneer or 24" oc maximum. Tie anchors shall be attached to metal studs with 2 - #12 self drilling self tapping screws.

FLASHING SYSTEM:

Thru-Wall Flashing system: 40 mil thick EPDM rubber membrane, containing no asphalt, equivalent to Sandell EPDM Rubber Thru-wall Flashing with Carlisle SecurTape splicing tape, and continuous pre-formed stainless steel drip edge. Install in compliance manufacturer's instructions.

Thru-wall flashing shall be completely secured into masonry joints or surface fully adhered throughout all wall assemblies, with all lap joints 100% sealed, in a complete continuous waterproof installation. Provide all necessary accessory components for a complete assembly; to include required roll-on primers, spray adhesives, pressure sensitive adhesive tape, termination bars, etc. wherever necessary.

Locations: Wall flashing system shall be installed over all masonry opening heads and sills, over all lintels in exterior walls, at all weephole locations, continuous around columns, and elsewhere indicated on Drawings.

Build a mock-up installation into the masonry sample panel for review and approval by Architect.

Required Thru-Wall Flashing Accessories:

Carlisle SecurTape Splicing Tape: 3" wide x 100' long roll, double-sided, synthetic cured rubber EPDM adhesive tape, .030" thick. Features a clear poly release film. Apply to cleaned EPDM flashing lap seams and adhere tightly with roller. Primers and spray adhesives shall be applied to surfaces to receive adhesive tape.

Sando-Seal lap sealant: Apply to all exposed edges at surface applied conditions, eliminating any voids, pockets or depressions where moisture would accumulate.

Sandell's S-600 Primer: Manufacturer's special primer formulated to prepare surfaces for adhering flashing to surfaces with pressure sensitive adhesive tape.

Sandell's Self-Adhering End Dams: preformed rubberized asphalt with adhesive surface and release layer film. Install above and beneath all wall openings, all longitudinal ends of flashing, lintel ends, at column abutments, near building expansion joints, and all cavity wall conditions whenever flashing interruptions occur.

Sandell's Self-Adhering Corners: preformed rubberized asphalt with adhesive surface and release layer film. Install at exterior and interior corner conditions. Flashing membrane shall overlap preformed corners, adhere and form a continuous waterproof seal.

Pre-Formed Stainless Steel Drip Edge: Provide a continuous pre-formed stainless steel drip edge at all flashings. 28 gauge, dull finish Type 304 stainless steel, ASTM A-167. Minimum 1 5/8" wide with a 3/8" bent safety drip edge. Flashing membrane shall lap and adhere onto drip edge for a continuous waterproof assembly. Flashing membrane shall be terminated at 1/2" from face of finished wall surface.

Weeps: Plastic weep inserts shall be Cell Vent Weep-Hole Ventilator by DUR-O-WALL or equivalent. 3/8" thick x full head joint height equivalent to brick size height, color clear. Install at all wall flashing locations with weepholes indicated on Drawings.

PART 3: EXECUTION

SURFACE CONDITIONS:

Inspection:

Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

Verify that concrete unit masonry may be completed in accordance with all pertinent codes and regulations, referenced standards, and the original design.

Discrepancies: In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been completely resolved.

COORDINATION:

Carefully coordinate with all other trades to insure proper and adequate interface of the work of other trades with the work of this Section.

INSTALLATION OF MASONRY:

GENERAL: Lay up all walls in running bond, plumb, level, and true to the lines and dimensions indicated on the Drawings. Maintain uniform head and bed joint of 3/8" vertically and horizontally. Masonry Contractor shall use sled runner jointing tool wherever possible to maintain consistency.

Do not use chipped or broken units. If any such units are discovered in the finished wall, the Architect may require their immediate removal and replacement with new units at no additional cost to the Owner.

Wetting of Brick: All brick shall be thoroughly wetted as necessary to reduce the rate of absorption of water a time of laying to not more than 0.7 of an ounce (20 grams per minute) per brick when placed on its flat side in 1/4" of water for one minute.

Brick Laying Technique:

All joints between brick shall be completely filled with mortar. Brick shall be laid in a full, lightly furrowed bed of mortar with the head joints completely filled by placing sufficient mortar on the end of the brick so that when the brick is shoved into place, the head joint will be filled. Buttering of face edge and then slushing will not be permitted. All joints, both interior and exterior shall be cut flush.

Disturbed Units: Where brick are disturbed or must be moved after the mortar has begun to lose its moisture, the brick and all adjacent mortar shall be removed and reset completely.

Tooling: Exterior and Interior brick joints shall be tooled to a uniform concave joint (unless otherwise noted) using a metal tool designed for that purpose, head joints first and then the bed joints. Interior CMU joints shall be tooled to a uniform concave joint. All joints shall be tooled at approximately the same degree of moisture content and firmness to achieve a uniform color and texture.

Where indicated provide raked tooled joints.

POINTING OF MASONRY:

At the completion of the masonry work, all holes in the exposed masonry shall be pointed. Defective joints shall be cut out and tuckpointed solidly with mortar. Pointing and tuckpointing shall be done with a pre-hydrated mortar. The mortar mix shall be controlled so that after curing of the mortar, no difference in texture or color exists with that of adjacent masonry. Where indicated, provide tuckpointing of existing masonry.

COLD WEATHER:

No bricklaying shall be performed unless the temperature of the surrounding air is 40 degrees F. and rising. The use of "anti-freeze" or accelerating admixtures is not permitted. Provide temporary protection of completed portions of masonry to insure a minimum 48 hours curing at a minimum 40 degrees F.

MASONRY OPENINGS:

The General Contractor and/or his masonry subcontractor shall be responsible for coordinating and building into all walls, the required openings necessary to permit the passage of duct work and piping by the mechanical contractors. These required openings shall be located and constructed as the work progresses. Knocking out large openings after work has been constructed will not be permitted. Structural lintels shall be furnished and installed by the General Contractor.

MASONRY CLEANING:

While laying the brick, good workmanship and job housekeeping practices shall be used so as to minimize the need for cleaning the brick. Protect the base of the wall from mud splashes and mortar droppings, protect the wall by setting scaffolds so that mortar is not deflected onto the wall, and at the end of each work day set the scaffolding boards so that they do not deflect rainfall onto newly laid masonry.

The bricklaying technique shall be such that mortar does not run down the face of the wall, or smear the mortar onto the brick face.

After the joints are tooled, cut off mortar tailings with the trowel and brush excess mortar burrs and dust from the face of brick. Do not bag or sack the wall, but use a bricklayer's brush made with medium soft hair.

Remove all large mortar particles with a hardwood scraper.

If after using the above outlined techniques, additional cleaning of the walls is found necessary, allow the walls to cure one month prior to and at the time the cleaning solution is applied.

Clean the wall only with an approved cleaning solution applied as recommended by the manufacturer. The solution shall be applied with a brush starting at the top of the wall. The use of any proprietary cleaning agents shall first be approved in writing by the manufacturer of the masonry being cleaned and

the Architect. The concentration, method of application of the cleaning solution, and method of scraping shall be as outlined on the container by the manufacturer.

High pressure water and sandblasting shall not be used for cleaning.

Immediately after cleaning a small area, the wall shall be rinsed thoroughly with quantities of water.

Protect adjacent surfaces and materials during brick cleaning operations.

After the walls are cleaned, take necessary precautions to insure that other contractors and subcontractors do not damage or soil the walls. Mud protection around the base of walls shall be left in place until the final grading work is done.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

1.1 SECTION INCLUDES

- A. Concrete masonry units.
- B. Reinforcement, anchorage, and accessories.

1.2 REFERENCES

- A. ACI 530-99 - Building Code Requirements for Masonry Structures.
- B. ACI 530.1-99 - Specifications For Masonry Structures.
- C. ASTM A82 - Cold-Drawn Steel Wire for Concrete Reinforcement.
- D. ASTM A123 - Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
- E. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.
- F. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- G. ASTM C55 - Concrete Building Brick.
- H. ASTM C90 - Load-Bearing Concrete Masonry Units.
- I. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction.
- J. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Hot Weather Masonry Construction.
- K. UL - Fire Resistance Directory.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate bars sizes, spacings, locations, reinforcement quantities, bending and cutting schedules, supporting and spacing devices for reinforcement, accessories.
- B. Product Data: Provide data for masonry units and fabricated wire reinforcement and accessories.
- C. Design Data: Indicate required mortar strength, masonry unit assembly strength in all planes, supportive test data.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 and ACI 530.1.
- B. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years experience.
- B. Installer: Company specializing in installing the Products specified in this section with minimum five years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products in workmanlike manner to avoid damage to units.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F 48 hours prior to, during, and 48 hours after completion of masonry work.
- B. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
- C. Maintain materials and surrounding air temperature to maximum 90 degrees F 48 hours prior to, during, and 48 hours after completion of masonry work.
- D. Hot Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Hot Weather Masonry Construction.

PART 2: PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Hollow Load Bearing Block Units (CMU): ASTM C90, Type I - Moisture Controlled blended light weight with individual unit net area compressive strength of 1900 psi.
- B. Solid Load-Bearing Block Units (CMU): ASTM C90, Type I - Moisture Controlled blended light weight with individual unit net area compressive strength of 1900 psi.
- C. Concrete Brick Units: ASTM C55, Type I - Moisture Controlled blended light weight of same Grade, Type, and Weight as block units with individual unit net area compressive strength of 1900 psi.
- D. Size and Shape: Nominal modular size. Provide special units for 90 and 45 degree corners, bond beams, lintels, and bullnosed corners.

2.2 REINFORCEMENT AND ANCHORAGE

- A. Single and Double Wythe Joint Reinforcement: Truss type; steel wire, hot dip galvanized to ASTM A 153 after fabrication, cold drawn steel wire conforming to ASTM A82, 3/16 inch side rods with No.9 diagonal ties. Reinforcing shall be units no more than two (2) inches smaller in width than the wall thickness and shall be of deformed rods 3/16" side rods and 9 gage diagonal cross rods all hot dipped galvanized.
- B. Joint Reinforcement for CMU/Brick Veneer Cavity Wall: Truss type in CMU backup wall; steel wire, hot dip galvanized to ASTM A 153 after fabrication, cold drawn steel wire conforming to ASTM A82, 3/16 inch side rods with No.9 diagonal ties. Backup wall reinforcing shall be units no more than two (2) inches smaller in width than the wall

thickness and shall be of deformed rods 3/16" side rods and 9 gage diagonal cross rods all galvanized. Veneer anchored with 3/16" keys and hooks, keys are 4-point flush-welded to backup wall rods. Total unit width shall be no more than two (2) inches smaller in width than the total wall thickness. Hooks shall be extended into veneer 1" from exterior face. Provide Hohmann & Barnard Adjusto-Flex-Mesh #AF-H Truss or equivalent.

- C. Provide prefabricated Tees and Corners at all wall intersections.
- D. Interior block partitions shall be reinforced similar to exterior backup walls.
- E. Spacing: Reinforcing for exterior and interior walls shall be 16" o.c. vertically beginning at the finish floor line and provide line of reinforcing one block course and one below all window heads and sills. Extend 16" beyond jambs on each side.
- F. Lap all splices one full panel of reinforcing unit.

2.3 WALL TIES TO STRUCTURAL STEEL:

- A. All exterior and interior masonry walls shall be hot-dip galvanized, tied to contiguous steel columns and beams with two piece adjustable tie units such as Heckmann 12 gage 315-D, Hohmann and Barnard 12 gage #359FH Weld-On Ties, or 12 gage Wire-Bond Type III anchors, with 3/16 diameter triangular wire ties or approved equal. Refer to Drawings General Notes.
- B. Space wall ties to columns and beams at 16" oc maximum. Tie anchors may be welded to structural steel with 4 fillet welds 1/8" x 3/4".
- C. Reinforcing Steel: ASTM A615, 60 ksi yield grade, deformed] billet bars, uncoated finish.
- D. Strap Anchors: As indicated on the drawings.

2.4 MORTAR AND GROUT

- A. Mortar: Type "S".
- B. Grout: Ready Mix 3000 psi pea gravel concrete as specified in Section 03300.

2.5 ACCESSORIES

- A. Preformed Control Joints: Neoprene as noted on the drawings.
- B. Joint Filler: Closed cell type as noted on the drawings.
- C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.6 LINTELS

- A. Bond beam type and steel lintels as noted on the drawings. Provide steel dowels to top flanges of steel beam lintels as noted on drawings. Provide dowels in bottom flanges of beams beyond the masonry openings as noted on the drawings.

2.6 EMBEDDED BEAMS

- A. Provide dowels in top and bottom flanges of beams embedded in masonry walls as noted on the drawings.

PART 3: EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Verify items provided by other sections of work are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other Sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave.

3.4 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
- D. Remove excess mortar as Work progresses.
- E. Interlock intersections and external corners unless otherwise noted on the drawings.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Cut mortar joints flush where wall tile is scheduled, cement parging is required, resilient base is scheduled, or bitumen damp proofing is applied.
- I. Isolate masonry partitions from vertical structural framing members with a control joint as indicated on drawings.

3.5 REINFORCEMENT AND ANCHORAGE

- A. Install horizontal joint reinforcement 16 inches oc.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 32 inches each side of opening.
- C. Place joint reinforcement continuous in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum one full panel.
- E. Support and secure reinforcing vertical bars from displacement with wire rod positioners as noted on the drawings. Maintain bars position within 1/2 inch of indicated position.
- F. Embed anchors attached to structural steel members. Embed anchorages in every second block joint.

3.6 LINTELS

- A. Install reinforced bond beam unit masonry lintels over openings where steel lintels are not scheduled.
- B. Do not splice reinforcing bars in lintels.
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of indicated position.
- D. Place and consolidate grout fill without displacing reinforcing.
- E. Allow masonry lintels to attain specified strength before removing temporary supports.
- F. Maintain minimum 8 inch bearing on solid masonry or steel on each side of opening.
- G. Refer to drawings for placement of control joints at ends of lintels.

3.7 GROUTED COMPONENTS

- A. Reinforce 8" wide bond beams with 1 - #5 top bar and, and 1 - #5 bottom bar 1 inch clear from bottom web. Reinforce 12" wide bond beams with 2 - #5 top bars and, and 2 - #5 bottom bars 1 inch clear from bottom web.
- B. Reinforce interior walls with #5 vertical bars spaced at 48" oc unless otherwise noted on the drawings. Place bars in maximum 6'-8" lifts. Lap splices 32", unless otherwise noted on the drawings.
- C. Reinforce exterior walls with #6 vertical bars spaced at 24" oc unless otherwise noted on the drawings. Place bars in maximum 6'-8" lifts. Lap splices 36", unless otherwise noted on the drawings.
- D. Place vertical bars in center of wythe.
- E. Lap splices in horizontal bars minimum 40 bar diameters. Stagger splices in adjacent bars. Dowel horizontal bars through HSS Steel column as noted on the drawings.
- F. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- G. Place and consolidate grout fill in 80" maximum lifts in cores containing bars without displacing reinforcing. Use water reducing plasticizers as required to maintain proper

slump for grouting cells 100% solid.

- H. At lintel bearing locations, fill masonry cores with grout for a minimum of 24 inches each side of opening from lintel bearing down to finish floor.
- I. Grout all masonry units 100% solid below finish floor and other locations noted on the drawings.
- J. Lay masonry units with core cells vertically aligned.
- K. Permit mortar to cure 7 days before placing grout.
- L. Reinforce masonry unit cores and cavities with reinforcement bars and grout as indicated on drawings.
- M. Retain vertical reinforcement in position with wire rebar positioners spaced at 48" maximum intervals full height of masonry.
- N. Wet masonry unit surfaces in contact with grout just prior to grout placement.
- O. When grouting is stopped for more than one hour, terminate grout 1-1/2 inches below top of upper masonry unit to form a positive key for subsequent grout placement.
- P. High Lift Grouting:
 - 1. Clean out masonry cells and cavities with high pressure water spray. Permit complete water drainage.
 - 2. Request inspection prior to grouting. Allow 3 days advance notice of inspection.
 - 3. After cleaning and cell inspection pump grout into spaces. Maintain water content in grout to intended slump without aggregate segregation.
 - 4. Limit grout lift to 80 inches and rod or mechanically vibrate for grout consolidation unless self consolidating grout is utilized. Wait minimum 120 minutes before placing next lift. Do not damage masonry with hydrostatic pressure from the grouting operations.

3.8 CONTROL AND EXPANSION JOINTS

- A. Continue horizontal joint reinforcement through control joints.
- B. Do not continue horizontal joint reinforcement through expansion joints.
- C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- D. Size control joint in accordance with Section 07900 for sealant performance.
- E. Form expansion joints as detailed.

3.11 BUILT-IN WORK

- A. As work progresses, install built-in metal door and glazed frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, and other items to be built-in the work and furnished by other sections.
- B. Install built-in items plumb and level.

- C. Bed anchors of metal door [and glazed] frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum 24 inches from framed openings.
- D. Do not build in organic materials subject to deterioration.

3.12 TOLERANCES

- A. Maximum Variation From Alignment: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/32 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and total 1/2 inch overall.
- D. Maximum Variation from Plumb: 1/4 inch per story.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

3.13 CUTTING AND FITTING

- A. Saw cut or core drill for neat fit at chases, pipes, conduit, sleeves. Coordinate with other sections of work to provide correct size, shape, and location. Fill space around penetrating devices with approved firestop materials.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.14 CLEANING

- A. Clean work with non acidic and non staining high pressure wash.
- B. Remove excess mortar and mortar smears as work progresses.
- C. Replace defective mortar. Match adjacent work.
- D. Clean soiled surfaces with cleaning solution.
- E. Use non-metallic tools in cleaning operations.

3.15 PROTECTION OF FINISHED WORK

- A. Protect finished Work form damage.
- B. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION

Water Penetration Resistance - Construction and Workmanship

Abstract: This *Technical Note* covers essential construction practices needed to assure water-resistant brick masonry. Procedures for preparing materials to be used in brick construction are recommended, including proper storage, handling and preparation of brick, mortar, grout and flashing. Good workmanship practices are described, including the complete filling of all mortar joints, tooling of mortar joints for exterior exposure and covering unfinished brick masonry walls to protect them from moisture.

Key Words: air space, brick, construction, flashing, initial rate of absorption, joints, mortar, tooling, weeps, workmanship.

SUMMARY OF RECOMMENDATIONS:

General

- Store materials on the job site to avoid wetting and contamination
- For drainage walls, keep the air space free of excessive mortar droppings
- Do not disturb newly laid masonry
- Cover tops of unfinished walls until adjacent construction protects them from water entry

Brick

- Pre-wet brick with a field measured initial rate of absorption (IRA) exceeding 30 g/min•30 in.² (30 g/min•194 cm²)

Mortar

- When mixing mortar, use accurate batching measurements and maximum amount of water that produces a workable mortar
- For brick with an IRA exceeding 30 g/min•30 in.² (30 g/min•194 cm²), increase water or maximize water retention by increasing lime proportions within limits of ASTM C 270
- For brick with an IRA lower than 5 g/min•30 in.² (5 g/min•194 cm²), reduce water or minimize water retention by decreasing lime proportions within limits of ASTM C 270

Joints

- In exterior wythes, completely fill all mortar joints intended to have mortar
- Minimize furrowing of bed joints and prohibit slushing of head joints
- Fill collar joints completely with grout or mortar, preferably grout; do not slush collar joints
- Tool mortar joints when thumbprint hard with a concave, "V" or grapevine jointer

Flashing and Weeps

- Do not stop flashing behind face of brickwork
- Where required, turn up flashing ends into head joint a minimum of 1 in. (25.4 mm) to form end dams
- Lap continuous flashing pieces at least 6 in. (152 mm) and seal laps
- Where installed flashing is pierced, make watertight with sealant or mastic compatible with flashing
- Install weeps immediately above flashing

INTRODUCTION

The best design, detailing and materials will not compensate for poor construction practices and workmanship. Proper construction practices, including preparation of materials and workmanship, are essential to achieve a water-resistant brick masonry wall.

This *Technical Note* discusses construction techniques and workmanship and is the third in a series of *Technical Notes* addressing water penetration resistance of brick masonry. Other *Technical Notes* in the series address brickwork design and details (7), materials (7A) and condensation (7C and 7D). Maintenance of brick masonry is addressed in *Technical Note* 46. All of these items are essential to obtain water-resistant brick masonry walls.

PREPARATION OF MATERIALS

Preparation of masonry materials before bricklaying begins is very important. Specific procedures must be followed to ensure satisfactory performance and avoid future problems. Preparation includes material storage, mixing mortar and grout and, in some cases, wetting the brick.

Storage of Materials

All materials at the jobsite should be stored to avoid contamination. Masonry units, mortar materials, ties and reinforcement should be stored off the ground, preferably in a dry location. In addition, all materials should be covered with tarpaulins or other weather-resistant materials to protect them from the elements.

Wetting Brick

Brick with an initial rate of absorption (IRA) greater than 30 g/min•30 in.² (30 g/min•194 cm²) at the time of laying tend to draw too much moisture from the mortar before initial set. As a result, construction practices should be altered when using brick with high IRA to achieve strong, water-resistant masonry. The IRA of brick in the field will typically be less than that reported in laboratory tests. Laboratory test results may be used to determine if measuring IRA in the field is necessary. ASTM C 67, Test Methods for Sampling and Testing Brick and Structural Clay Tile, includes a standard procedure for measuring IRA in the field.

A crude method of indicating whether brick need to be wetted prior to placement consists of drawing, with a wax pencil, a circle 1 in. (25.4 mm) in diameter on the brick surface that will be in contact with the mortar. A quarter can be used as a guide for the circle. With a medicine dropper, place 20 drops of water inside this circle and note the time required for the water to be absorbed. If the time exceeds 1½ minutes, the brick should not need wetting; if less than 1½ minutes, adjustments to typical construction practice are recommended.

Specification for Masonry Structures [Ref. 4] requires that brick with an IRA exceeding 30 g/min•30 in.² (30 g/min•194 cm²) be wetted prior to laying to produce an IRA less than 30 g/min•30 in.² (30 g/min•194 cm²) when the units are placed. However, execution of this method may be impractical on large-scale construction projects and the contractor may consider other alternatives, as discussed in the following section, Mixing of Mortar and Grout.

If brick are to be wetted, the method of wetting is very important. Sprinkling or dipping the brick in a bucket of water just before laying would produce the surface wet condition which may not be sufficient, as shown in **Figure 1b**. The units should have a saturated interior, but be surface dry at the time of laying, as shown in **Figure 1d**.

Satisfactory procedures for wetting the brick consist of letting water run on the cubes or pallets of brick, or placing them in a large tank of water. This should be done the day before the units are laid, or not later than several hours before the units will be used so that the surfaces have an opportunity to dry before the brick are laid. Wetting low-absorption brick or excessive wetting of brick may result in saturation, as shown in **Figure 1c**. This can cause “bleeding” of the mortar joints and “floating” of the brick.

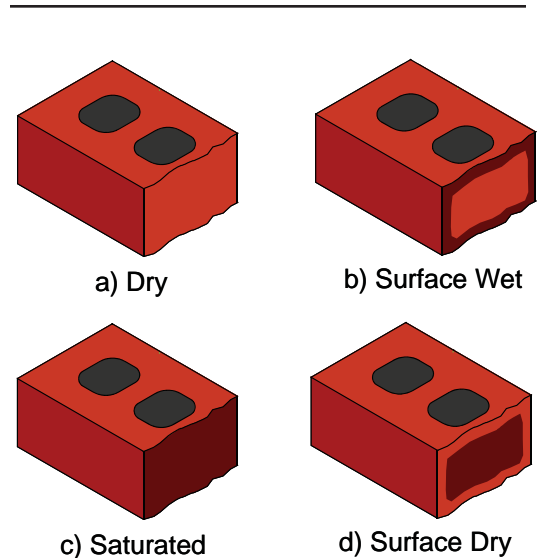


Figure 1
Moisture Content of Brick

Mixing of Mortar and Grout

Typically, a high water content in the mortar is necessary to obtain complete and strong bond between mortar and brick. In general the mortar should be mixed with the maximum amount of water that produces a workable mortar. Factors such as the jobsite environment and the IRA of the brick should be considered when determining the proper amount of water to include in the mortar.

Mortar to be used with brick that have an IRA greater than 30 g/min•30 in.² (30 g/min•194 cm²) should be mixed to maximize water retention by increasing mixing water or lime content within the limits of ASTM C 270. This is particularly important when pre-wetting the brick to reduce their IRA is impossible or impractical. Admixtures designed to increase the water retention of the mortar may also be used to improve the compatibility of mortar with high IRA brick. Only admixtures with test data showing no deleterious effects should be used.

Mortar for use with brick that have an IRA less than 5 g/min•30 in.² (5 g/min•194 cm²) should be mixed with reduced amounts of water or lime to minimize water retention. Lime proportions should remain within the limits of ASTM C 270.

When brick with widely different absorption rates are used together in brickwork, it is important to maintain the correct water content in the mortar used with the different brick.

All cementitious materials and aggregates must be mixed for at least 3 minutes and not more than 5 minutes in a mechanical batch mixer. If, after initial mixing, the mortar stiffens due to the loss of water by evaporation, addi-

tional water should be added and the mortar remixed (retempered). All mortar should be used within 2½ hr (2 hr in hot weather conditions, see *Technical Note 1*) of initial mixing and grout should be used within 1½ hour of introducing water into the mix. No mortar or grout should be used after it has begun to set.

One of the most common problems with mortar is oversanding. Oversanded mortar is harsh, unworkable and results in poor extent of bond and reduced bond strength, thus increasing the potential for water penetration problems. The cause of oversanding is frequently the use of the shovel method of measuring the sand. The amount of sand that a shovel will hold varies depending on the moisture content of the sand, the person doing the shoveling and the different size of shovels used on the jobsite. To alleviate this problem, proper batching methods must be used. Measurement of sand by shovel should not be permitted without periodically gauging the shovel count using a bucket or box of known volume. *Technical Note 8B* provides detailed guidelines for various methods of more accurately batching mortar.

Blending of Brick

While not related to water penetration resistance, blending of brick at the jobsite is an important preparation task related to workmanship and the acceptable appearance of brickwork. Because brick is made from natural materials that vary in physical properties, variations in color may occur between production runs and occasionally within the same run. Modern manufacturing processes use automatic equipment which may not permit inspection of each brick, also resulting in minor color and texture variations. For these reasons, straps of brick from different cubes should be placed together around the wall. The mason should then select brick from adjacent straps when laying a given section of brickwork. By blending the brick throughout the wall in this manner, the effect of potential color variations on the finished brickwork is minimized.

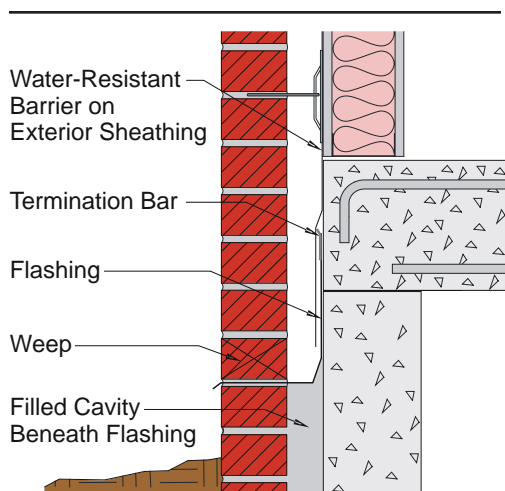


Figure 2
Wall Base Flashing Detail

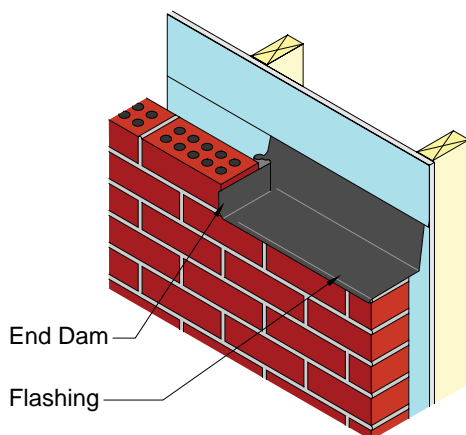


Figure 3
End Dam Detail

WORKMANSHIP

The importance of good workmanship to attain quality brickwork cannot be overemphasized. While design and the quality of materials contribute to the water penetration resistance of brickwork, workmanship is a highly important factor in the construction of water-resistant masonry.

Placing Flashing and Weeps

Flashing must be installed properly and integrated with adjacent materials to form an impervious barrier to moisture movement. The flashing should be wide enough to start outside the exterior face of the brick wythe, extend across the cavity, and turn up vertically against the backing or interior wythe at least 8 in. (203 mm). The top (vertical) edge should be placed in a mortar joint of the backing wythe, in a reglet in concrete backing, or attached to sheathing with a termination bar, as shown in *Figure 2*. Sections of flashing are to be overlapped at least 6 in. (152 mm) and the lap sealed with a compatible adhesive. Water-resistant sheet membranes should overlap the flashing in a shingle fashion by at least 6 in. (152 mm).

Flashing that is placed so that the outside edge projects from the face of the wall may be cut flush with the face of the brickwork. In no circumstances should the flashing be stopped behind the face of the brickwork. Continuity at corners and returns is achieved by cutting and folding straight sections or using preformed corner pieces. Discontinuous flashing should terminate with an end dam in a head joint, rising at least 1 in. (25.4 mm) as shown in *Figure 3*.

Flashing must be placed without punctures or tears. Openings created for reinforcement or anchors must be closed with a compatible sealant. Protection may be needed around bolts fastening shelf angles to the structure.

Weeps are required, and should be formed in mortar joints immediately above the flashing. Open head joints, formed by leaving mortar out of a joint, are the recommended type of weep. Open head joint weeps should be at least 2 in. (51 mm) high. Weep openings are permitted by most building codes to have a minimum diameter of $\frac{3}{16}$ in. (4.8 mm). The practice of specifying the installation of weeps one or more courses of brick above the flashing can cause a backup of water and is not recommended. Non-corrosive metal, mesh or plastic screens can be installed in open head joint weeps if desired.

Spacing of open head joint weeps at no more than 24 in. (610 mm) on center is recommended. Spacing of wick and tube weeps is recommended at no more than 16 in. (406 mm) on center. Weep spacing is permitted by most building codes up to 33 in. (838 mm) on center. If other than an open head joint weep is used, be sure the weep is clear of all mortar to allow the wall to drain (see *Technical Note 21C*). Rope wicks should be flush with, or extend $\frac{1}{2}$ in. (12.7 mm) beyond the face of the wall to promote evaporation. The rope should continue into the bottom of the air space, placed along the back of the brick and be at least 16 in. (406 mm) long.

Filling Mortar Joints

To reduce water penetration, there is no substitute for proper filling of all mortar joints that are designed to receive mortar. Improperly filled mortar joints can result in leaky walls, reduce the strength of masonry, and may contribute to disintegration and cracking due to water penetration and subsequent freezing and thawing.

A uniform bed of mortar should be spread over only a few brick, and furrowed lightly, if at all. Filled joints result when plenty of mortar is placed on the end of the brick to be laid and it is shoved into place so that mortar is squeezed out of the top of the head joint, as shown in **Photo 1**. After placement, mortar squeezed out of bed joint should be cut off prior to tooling, as shown in **Photo 2**. When placing closures, plenty of mortar is needed on the ends of brick in place and on the ends of the brick to be laid. The closure should be shoved into place without disturbing brick on either side, as shown in **Photo 3**.

Bed Joints. A bed joint is the horizontal layer of mortar on which a brick is laid. The length of time between placing the bed joint mortar and laying the succeeding brick influences the resulting bond. If too long a time elapses, poor extent of bond will result. Brick should be laid within 1 minute or so after the mortar is placed.

For solid brick, bed joints should be constructed without deep furrowing of the mortar, as full bed joints (covering the entire bedding surface) are an inherent requirement for water-resistant brick masonry construction. For hollow brick, bed joints may be laid with face shell bedding (mortar placed only on the front and back face shells). Both face shells must be completely covered with mortar.

Head Joints. A head joint, sometimes called a cross joint, is the vertical mortar joint between two brick. For both solid and hollow brick it is important that head joints be completely filled. The best head joints are formed by completely buttering the ends of the brick with mortar and shoving the brick into place against previously laid brick.



Photo 1
Shoving Brick into Place



Photo 2
Cutting Excess Mortar



Photo 3
Placing the Closure

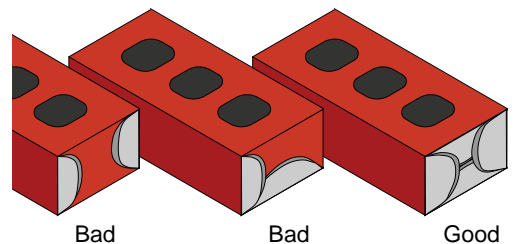


Figure 4
Head Joints



Photo 4
Concave Mortar Joints



Photo 5
"V" Mortar Joints

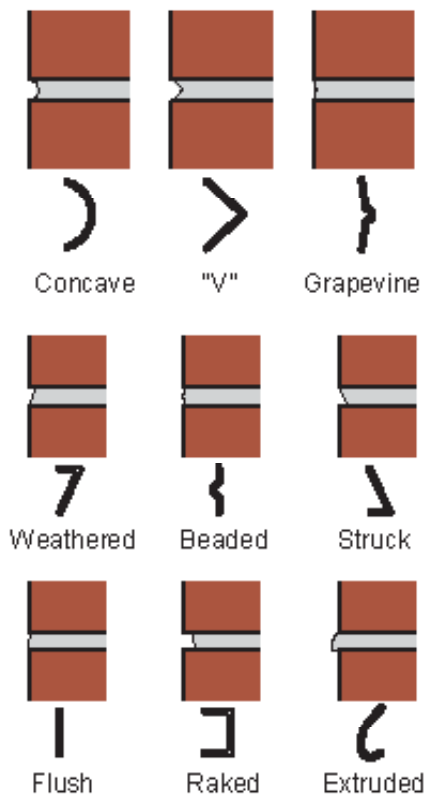


Figure 5
Typical Mortar Joints

"Slushing" ("throwing" mortar into the joint with the edge of a trowel) does not adequately fill joints or compact the mortar, resulting in joints that are less resistant to water penetration. The results of head joint forming are shown in [Figure 4](#).

Tooling of Mortar Joints

Proper tooling, or "striking", of mortar joints helps seal the wall surface against moisture penetration. Mortar joints should be tooled when they are "thumbprint" hard, (pressing the thumb into the mortar leaves an indentation, but no mortar is transferred to the thumb) with a jointer slightly larger than the joint. It is important that joints are tooled at the appropriate time as this affects both their effectiveness and appearance. Joints that are tooled too early often smear and result in rough joints. If tooling is delayed too long the surface of the joint cannot be properly compressed and sealed to the adjacent brick. Each portion of the completed brickwork should be allowed to set for the same amount of time before tooling in order to ensure a uniform mortar shade. Early tooling often results in joints of a lighter color. Later tooling results in darker shades.

Concave, "V" and grapevine joints best resist water penetration in exterior brickwork. These joints produce a more dense and weather-tight surface, as the mortar is pressed against the brick, as shown in [Photos 4 and 5](#). For interior masonry work, other joints such as the weathered, beaded, struck, flush, raked or extruded joints shown in [Figure 5](#) can also be used.

Collar Joints

The vertical, longitudinal joint between wythes of masonry is called a collar joint. The manner in which these joints are filled is very important. Grouting is the most effective method of ensuring that collar joints are completely filled. However, grouting spaces less than $\frac{3}{4}$ in. (19.1 mm) is not permitted. Mortar protrusions (fins) that extend more than $\frac{1}{2}$ in. (12.7 mm) into a cell or cavity that will be grouted must be removed prior to grouting. For mortar-filled collar joints, the outer face of the inner masonry wythe should be parged and the back of brick in the exterior wythe buttered in order to fill the collar joint.

"Slushing" of collar joints is not effective since it does not completely fill all voids in the joint, as shown in [Photo 6](#). Frequently, the mortar is

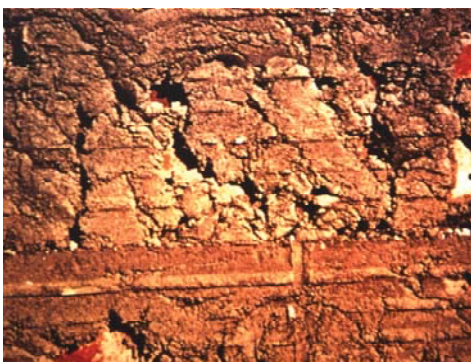


Photo 6
Poorly Filled Collar Joint

caught and held before it reaches the bottom of the joint, leaving openings between the face brick and the backing. Even when this space is filled, there is no way to compact the mortar. The mortar does not bond with the brick over its entire surface and channels are left between the mortar and the brick. Some of these channels may allow water to reach the back of the wall. A properly constructed collar joint is completely filled with grout or mortar.

Parging

Parging is the process of applying a coat of portland cement mortar to masonry. Parging the outer face of the inner wythe of a multiwythe wall with Type M or S mortar as damp proofing may help resist rain penetration and can also reduce air leakage. Membranes or liquid-applied materials usually provide superior performance to parging, which will crack if the wythe cracks. However, parging can provide a smooth base for these materials. If parging alone is to resist water penetration, proper curing is necessary to reduce shrinkage cracks. Parging the back side of the exterior wythe is not recommended for drainage-type walls, as this may result in more debris in the air space or break the brick/mortar bond.

The face of the wall to be parged must not have any mortar protrusions. Protruding mortar can cause bond breaks in the parge coat, resulting in a leaky wall. When applied in multiple layers, each should be a minimum thickness of $\frac{1}{4}$ in. (6.4 mm). The first coat should be allowed to partially set, roughened, and allowed to cure for 24 hours. It is then moistened for application of the second coat. The parged surface should be troweled smooth so that it sheds water easily. When completed in adjacent areas, the edges of the parging should be feathered and new parging should overlap existing parging by a minimum of 6 in. (152 mm). Lap joints should be spaced no closer than 6 feet (1.83 m).

Keeping Air Spaces Clean

In a drainage wall system, such as a cavity wall or an anchored veneer wall, it is essential that the air space be kept clean. If it is not, mortar droppings may clog the weeps, protrusions may span the air space and water penetration to the interior may occur.

To the greatest extent possible, mortar droppings should be prevented from falling into the air space or cavity. An aid to prevent this is to bevel the bed joint away from the air space or cavity, as shown in [Figure 6](#). When brick are laid on a beveled bed joint, a minimum of mortar is squeezed out of the joint, as shown in [Photo 7](#). The mortar squeezed from the joints on the air space or cavity side may be troweled onto the units. This same procedure may be used for laying the exterior wythes of grouted and reinforced brick cavity walls.

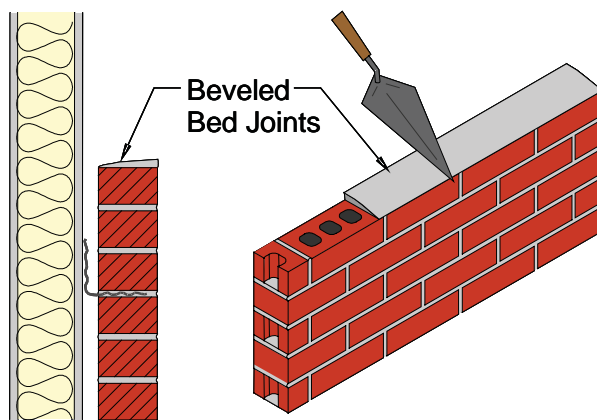


Figure 6
Beveled Bed Joints

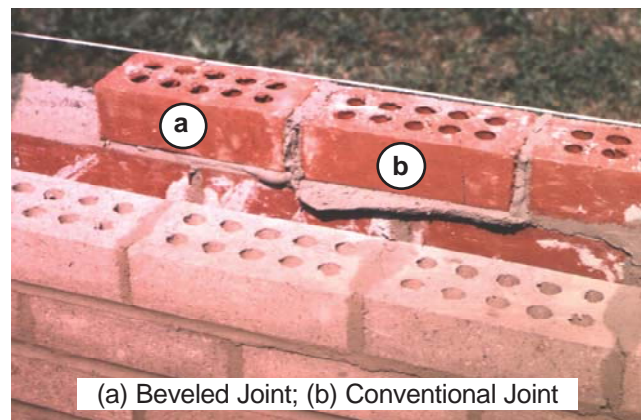


Photo 7
Beveled and Conventional Mortar Joints

Another method allows access to the base of the cavity for cleaning. When the brickwork is initially constructed, every third brick or so in the course above the flashing of the exterior wythe is omitted. Once the brickwork is complete, mortar droppings at the base of the cavity can be easily removed and weeps provided when the omitted brick are placed in the wall with mortar.

Alternately, a wooden or metal strip, slightly smaller than the cavity width, can be placed in the air space. This strip rests on the wall ties as the wall is built. Wire or rope is attached to the strip so the strip can be lifted out as the mason builds the wall. Care should be taken when raising or removing the strip to not disturb the brickwork.

Drainage materials and mortar dropping control devices may also be used to keep the air space adjacent to the weeps free from mortar. Use of these devices does not guarantee that bridging of the air space will not occur, thus the amount of mortar droppings should be limited as much as possible.

Disturbance of Newly Laid Masonry

Newly laid brick should never be pushed, shoved, tapped or otherwise disturbed once they are laid in their final position and the mortar has begun to set. Any disturbance at this point will break the bond and may lead to a leak. If adjustments are necessary, the incorrectly placed brick should be removed and re-laid in fresh mortar.

Protection of Unfinished Brickwork

Covering of masonry walls at the end of each work day, and especially in times of inclement weather, is essential for satisfactory performance. Covering unfinished walls with tarpaulins or other water-resistant materials, securely tied or weighted in position, should be rigorously enforced. Mortar boards, scaffold planks and light plastic sheets weighted with brick should not be accepted as suitable cover. Metal clamps, similar to bicycle clips, are commercially available in a variety of sizes to meet various wall thicknesses. These are used in conjunction with plastic sheets or water-repellent tarpaulins and offer excellent protection for extended periods of time.

Tops of walls should also be covered after the mason's work is finished if a permanent coping is not attached immediately after the brickwork is completed. Protection of openings in brickwork such as those for windows, movement joints, etc. should also be considered as they may allow moisture ingress from rain and snow and can lead to moisture-related problems such as efflorescence, and in some cases could affect the final mortar color.

SUMMARY

Quality construction practices and good workmanship are essential to achieve brickwork that is resistant to water penetration. This *Technical Note* does not cover all construction practices, but describes material storage and preparation procedures, construction practices and installation techniques that are indicative of high quality and, when combined with proper design, detailing and materials, result in brickwork that is resistant to water penetration.

The information and suggestions contained in this Technical Note are based on the available data and the combined experience of engineering staff and members of the Brick Industry Association. The information contained herein must be used in conjunction with good technical judgment and a basic understanding of the properties of brick masonry. Final decisions on the use of the information contained in this Technical Note are not within the purview of the Brick Industry Association and must rest with the project architect, engineer and owner.

REFERENCES

1. *The BDA Guide to Successful Brickwork*, Second Edition, The Brick Development Association, Arnold (a member of the Hodder Headline Group), London, England, 2000.
2. Drysdale, R.G., Hamid, A.A., and Baker, L.R., *Masonry Structures: Behavior and Design*, Second Edition, The Masonry Society, Boulder, CO, 1999.
3. Koski, J.A., "Waterproof the Backup Wythe," *Masonry Construction*, August 1992.
4. *Specification for Masonry Structures*, ACI 530.1-05/ASCE 6-05/TMS 602-05, The Masonry Society, Boulder, CO, 2005.

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

SECTION INCLUDES

- A. Structural steel columns, beams, lintels, trusses, rod bracing, and other steel framing members.
- B. Base plates, column anchor bolts,
- C. Steel to steel connection bolts.

REFERENCES

- A. ASTM A36, A992 –Structural Steel.
- B. ASTM A53 – Grade B Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- C. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.
- D. ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
- E. ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.
- F. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
- G. ASTM A325 - High Strength Bolts for Structural Steel Joints.
- H. ASTM A490 - Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints.
- I. ASTM A500 – Grade B Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Rectangular Shapes.
- J. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- K. ASTM A572 - High Strength Low Alloy Columbium-Vanadium Steel of Structural Quality.
- L. ASTM F1554 – Anchor Rods
- M. AWS A2.0 - Standard Welding Symbols.
- N. AWS D1.1 - Structural Welding Code.
- O. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings – Allowable Stress Design..
- P. AISC - Specification for Architectural Exposed Structural Steel.
- Q. SSPC - Steel Structures Painting Council.

SUBMITTALS

- A. Shop Drawings:

1. Indicate dimensions, elevations, profiles, sizes, spacing, and locations of structural members, miscellaneous members, attachments, and fasteners.
 2. Connections detailed fully.
 3. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths and returns.
 4. All truss connections shall be fully welded all around. All truss members shall be fully closed so as not to allow moisture to collect inside.
- B. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
- C. Mill Test Reports: Submit indicating structural strength, destructive and non-destructive test analysis.
- D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
- B. Perform Exposed Work in accordance with AISC - Specification for Architectural Exposed Structural Steel.

QUALIFICATIONS

- A. Fabricator: Company specializing in performing the work of this Section with minimum five years documented experience.
- B. Design connections not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of North Carolina.

FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on Drawings.

PART 2 PRODUCTS

MATERIALS

- A. Structural Steel Wide Flange Members: Certified to ASTM A992 (Fy = 50 ksi).
- B. Plates, Angles, Bars: Certified to ASTM A36 (Fy = 36 ksi)
- C. Rods: to ASTM A36 (Fy = 36 ksi)
- D. Structural Tubing: ASTM A500, Grade B (Fy = 46 ksi).
- E. Pipe: ASTM A53, Grade B (Fy = 35 ksi).
- F. Bolts, Nuts, and Washers: ASTM A325.

- G. Anchor Rods: ASTM A1554 Grade 36.
- H. Welding Materials: AWS D1.1; type required for materials being welded.
- I. Headed Shear Studs: ASTM A108 Type B, Fu = 60 ksi.
- J. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7000 psi at 7 days.
- K. Shop Applied Primer - Epoxy Finished Members: One coat of green solvent based inorganic zinc. Shop primer shall be certified to be compatible with the intumescent fireproofing and UL assemblies, and with epoxy systems as applicable and specified. Reference Section 09900.
- L. Shop Applied Primer – Exposed and Intumescent Fireproofed Members: One coat of grey oxide alkyd. Shop primer shall be certified to be compatible with the intumescent fireproofing and UL assemblies, as applicable and specified. Reference Section 09900.
- M. Shop Applied Primer – Cementitious Spray-on Fireproofed Members: Not required to be primed. Shop primer shall be certified to be compatible with the fireproofing UL assemblies.

FINISH

- A. Prepare structural component surfaces required to be shop primed in accordance with SSPC SP-2, SP-3 or SP-6 as applicable for the final finish type. Reference Section 09900.
- B. Shop priming is required for all exposed to view structural steel members. Shop priming not required for structural steel members where steel is to be enclosed and concealed from view in walls and ceilings or encased in concrete or masonry. Shop primer shall be certified to be compatible with the intumescent fireproofing and epoxy systems and applicable UL assemblies. Apply sufficient primer to insure required dry film thicknesses specified. Reference Section 09900.
 - 1. Members finished with epoxy systems: 2-3 mils DFT, SP-6 surface preparation
 - 2. Members finished with alkyd systems: 2 mils DFT, SP-2 or SP-3 surface preparation
- C. Members to receive cementitious spray-on fireproofing are not required to be primed. Shop primer shall be certified to be compatible with the fireproofing UL assemblies.
- D. Top flanges of beams receiving headed shear studs embedded within concrete shall not be primed.
- E. Lintels in exterior walls shall be hot dip galvanized to G60 standards, after fabrication. All seams in built-up members to be hot dip galvanized such as beam and plate lintels shall be seal welded.

PART 3 EXECUTION

EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Verify that lay down areas are sufficient, clean, level, and of sufficient strength and stability to support safely members and handling equipment.

HANDLING AND STORAGE

- A. Provide proper equipment too safely off load material to prevent damage.
- B. Provide adequate dunnage and skids to keep steel from getting muddy and dirty.
- C. Store steel in such a manner to prevent the accumulation of water and debris.
- D. Do not erect steel that is muddy or stained with any deleterious material. Clean steel if necessary before erection.

ERECTION

- A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- B. Do not field cut or alter structural members without approval of Architect/Engineer.
- C. After erection, clean and prime paint welds, abrasions, and surfaces where shop primer has been disturbed, deteriorated or damaged.
- D. All eaves shall be aligned to be straight and true. All joist extended ends at the eaves and all HSS outriggers at the gables shall be pulled into alignment and securely welded to the continuous edge plate or angle as applicable. Edge plates and angles shall be string lined for straightness.
- E. Gable outriggers shall be accurately laid out to fit under the wide flute of the metal deck and shall be welded to the top of the affected joists. The metal deck shall be puddle welded to the top of the HSS outriggers at 12" o.c. in addition to welding to the supporting joists.
- F. The bent plate ridge plate shall be aligned vertically and horizontally and shall be securely welded to the ends of the joist extended ends to form straight and level ridge.
- G. The continuous eave bent plates and gable edge angles shall be butt welded straight and full strength at joints. Provide a break in the continuous bent plate and angle members over supports at maximum 40 foot intervals. The minimum length of these members shall be 20 feet. These break joints shall be over a support and shall be welded thereto.
- H. Grout under column base plates to get full uniform bearing.

FIELD QUALITY CONTROL

- A. Field inspection will be performed by the Architect.
- B. All connection bolts and field welds shall be inspected by an independent testing lab selected by the owner and paid by the contractor from the material testing allowance.
- C. All steel beam to beam, beam to column, brace connections, and joist girder to column. Joists to joist girder, and joists to column connection bolts shall be tightened to a snug tight condition.
- D. Shop welds and fabrication quality shall be certified by the materials testing laboratory. At the option of the lab the inspection may be conducted in the field after delivery or at the fabrication plant during fabrication and/or prior to shipment.
- E. All structural steel members shall be inspected by the testing laboratory for sweep, camber, and twist to comply with ASTM A6 and AISC Code of Standard Practice for fabricated structural steel. Types of weld tests and frequency of tests shall comply with AWS D1.1 - Structural Welding Code, 2006 Edition.

- F. All out of tolerance members shall be corrected prior to erection by the contractor.
- G. All connections with misfitting bolts shall be field welded as directed by the inspector to fully compensate for the strength of the misfitting bolts.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

SECTION INCLUDES

- A. Open web steel joists, joist girders, with bridging, extended ends, bolted bridging bolts, and other joist accessories.

REFERENCES

- A. ASTM A36/A36M, A992 - Structural Steel.
- B. ASTM A500 – Grade B
- C. ASTM A242/242M - High Strength Low Alloy Structural Steel.
- D. ASTM A529/529M Grade 50 - High Strength Carbon-Manganese Steel of Structural Quality.
- E. ASTM A572/572M Grade 50 - High Strength Low Alloy Columbian-Vanadium Steel of Structural Quality.
- F. ASTM A588/588M - High Strength Low Alloy with 50 kis Minimum Yield Point to 4 inches thick.
- G. ASTM A606 - Steel Sheet and Strip, Hot Rolled and Cold Rolled High-Strength Low Alloy, with Improved Corrosion Resistance.
- H. ASTM A1011/A1011M - Steel, Sheet and Strip Hot Rolled, Carbon, Structural High Strength Low-Alloy and High Strength Low Alloy with Improved Formability.
- I. ASTM A1008/A1008M - Steel, Sheet Cold Rolled, Carbon, Structural High Strength Low-Alloy and High Strength Low Alloy with Improved Formability.
- J. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.
- K. ASTM A307 - Carbon Steel Threaded Standard Fasteners.
- L. ASTM A325 - High Strength Bolts for Structural Steel Joints.
- M. ASTM A53 – Grade B
- N. AWS D1.1 - Structural Welding Code.
- O. FM - Roof Assembly Classifications.
- P. SJI (Steel Joist Institute) - Specifications, Load tables, and Weight Tables for Steel Joists and Joist Girders.
- Q. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.
- R. UL - Fire Resistance Directory.
- W. Warnock Hersey - Certification Listings.

SUBMITTALS FOR REVIEW

- A. Shop Drawings and Erection Plans and Diagrams:
 - 1. Indicate standard designations, configuration, sizes, spacing, locations of joists, joist girders, trusses, top and bottom chord extensions, bolted connections, welded connections.
 - 2. Coding of bridging, connections, attachments, and accessories for complete installation.
 - 3. Cambers in adjacent members shall be uniformly controlled to be no greater than required by SJI standards.

SUBMITTALS FOR INFORMATION

- A. Welders' Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

QUALITY ASSURANCE

- A. Perform Work in accordance with SJI, Load Tables, and Weight Tables.
- B. Maintain one copy of each shop drawing document on site.
- C. Fabricator: Company specializing in performing the work of this section with minimum five years experience.
- D. Erector: Company specializing in performing the work of this section with minimum five years experience.
- E. Joists and Joist Girders and their connections not detailed on the Drawings shall be designed by Professional Engineer experienced in design of this work and licensed in the State of North Carolina and employed by the joist supplier.

DELIVERY, STORAGE, AND PROTECTION

- A. Material and Equipment: Transport, handle, store, and protect products to SJI requirements so as not to damage, bend or otherwise distort members from their fabrication conditions.

PART 2 PRODUCTS

MATERIALS

- A. Open Web Joists Members: SJI Type K, KCS, LH Longspan, G series Joist Girders.
- B. Bolts, Nuts and Washers: ASTM A325.
- C. Structural Steel For Supplementary Framing, Joist Extensions, and Joists Substitutes.
- D. Welding Materials: AWS D1.1; type required for materials being welded.
- E. Shop and Touch-Up Primer:
 - 1. SSPC 15, Type 1, grey oxide alkyd for joists permanently exposed to view. Reference 09900.
 - 2. Joists permanently concealed may not receive shop primer at contractor's option.
 - 3. Joists to receive cementitious spray-on fireproofing do not require primer. Primer if used shall be certified to compatible with fireproofing UL assemblies.

FABRICATION

- A. Provide bottom and top chord extensions as indicated. Top chord extensions shall be continuous smooth straight extensions of the joist top chord without bends or sweeps.
- B. Fabricate to achieve minimum end bearing of 2-1/2 inches on steel for K series, 5" for LH series, 6" for G series joist girders. Refer to drawings for additional bearing requirements for sloping joists and joist girders.
- C. Provide for 3/4" diameter A325 connection bolts for joist to joist girder, and joist to column, and joist to beam connections. Provide field welded connections for all field bolted connections after adjustment and plumbing of the structural frame.
- D. Provide 1/2" ASTM A307 bolts for all field bolted diagonal bridging requirements.
- E. Drill or punch not burn holes in girder chords and flanges and column cap plates necessary for attachment of bolted joists.

FINISH

- A. Prepare joist component surfaces to receive shop primer in accordance with SJI standards.
- 4. B. Shop prime joists that are to be exposed to view. Joists to receive cementitious spray-on fireproofing do not require primer. Primer if used shall be certified to compatible with fireproofing UL assemblies.

SOURCE QUALITY CONTROL AND TESTS

- A. Provide shop testing in accordance with SJI standards.

PART 3 EXECUTION

EXAMINATION

- A. Coordination: Verification of existing conditions prior to beginning fabrication work.
- B. Production prior to approval of shop drawings shall be at contractor's risk.

ERECTION

- A. Erect and connect joists to supports.
- B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment. Strictly follow all OSHA regulations for job safety.
- C. Install, field weld and/or bolt joist seats to supports as erection progresses.
- D. Position and field weld joist bottom chord extensions as erection progresses.
- E. Frame roof openings greater than 12 x 12 inches with supplementary framing.
- F. Do not permit erection of decking until completion of installation of permanent bridging and bracing.
- G. Do not field cut or alter structural members without approval of joist manufacturer.

- H. All joist top chord extensions at ridges and eaves shall be brought into close alignment and securely field welded to the continuous ridge and eave angles or plates to give true and straight line to ridges and eaves.
- I. After erection, prime welds, abrasions on shop primed joists.

ERECTION TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch.
- B. Maximum Offset From True Alignment: 1/4 inch.

FIELD QUALITY CONTROL

- A. Field inspection will be performed by the Architect. Additional inspection of materials and connections shall be performed by an independent testing laboratory at the direction of the Architect. Payment for the testing laboratory services will be paid by the contractor out of the testing allowance.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART I: GENERAL

SECTION INCLUDES

- A. Steel roof deck and accessories.
- B. Formed steel ridge strips, eave strips, valley strips, fasteners, and sound attenuation strips for acoustical deck flute filler.

REFERENCES

- A. ASTM A36/A36M — Structural Steel.
- B. ASTM A1008/A1008M — Primed Sheet Steel, Cold—Rolled Sheet, Carbon, Structural Quality with minimum yield strength of 33 ksi.
- C. ASTM A653/A653M — Galvanized Sheet Steel, Cold—Rolled Sheet, Carbon, Structural Quality with minimum yield strength of 33 ksi.
- D. AWS D1.1 — Structural Welding Code.
- E. FM — Roof Assembly Classifications.
- F. SDI (Steel Deck Institute) — Design Manual for Composite Decks, Form Decks, Roof Decks, Cellular Metal Floor Deck with Electrical Distribution.
- G. SSPC (Steel Structures Painting Council) — Painting Manual.
- H. UL — Fire Resistance Directory.
- I. Warnock Hersey — Certification Listings.

PERFORMANCE REQUIREMENTS

- A. Design metal deck in accordance with SDI Design Manual.
- B. Deck units shall be laid out in a minimum three span condition.

SUBMITTALS FOR REVIEW

- A. Shop Drawings: Indicate deck plan, support locations, projections, openings, pertinent details, fastening patterns, and accessories with fastening patterns.
- B. Product Data: Provide deck profile characteristics and dimensions, structural properties, finishes, and fasteners for side laps.

SUBMITTALS FOR INFORMATION

- A. Certificates: Certify that Products meet or exceed specified requirements.
- B. Submit manufacturer's installation instructions.

- C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

QUALITY ASSURANCE

- A. Manufacturer: Company specializing furnishing material under this specification for a minimum of five years.
- B. Installer: Company specializing in performing the work of this Section with minimum five years experience.
- C. Design deck layout, spans, fastening, joints, under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of North Carolina.

DELIVERY, STORAGE, AND HANDLING

- A. Material and Equipment: Transport, handle, store, and protect products from damage.
- B. Cut plastic wrap to encourage ventilation.
- C. Store deck and accessories on dry wood sleepers; slope for positive drainage.
- D. Store acoustical metal deck indoors to prevent rusting of the punched deck flutes. Store sound attenuation strips when required in sealed packages indoors out of the weather.

PART 2 PRODUCTS

MATERIALS

- A. Manufacturers:
 - 1. Vulcraft 1 ½" deep type 1.5 B, 22 gage with 36 " cover. Vulcraft 3" deep type N, 22 gage with 24" cover. Regular and Acoustical Deck units.
 - 2. Wheeling 1 ½" type B, 22 gage with 36" cover. Wheeling 3" deep type N, 22 gage with 24" cover. Regular and Acoustical Deck units.
 - 3. United Steel Deck 1 ½" type B, 22 gage with 36" cover. United 3" deep type N, 22 gage with 24" cover. Regular and Acoustical Deck units.
- B. Sheet Coating: 1 ½" type B regular and 3" type N shall be primed. Roof deck primer where cementitious spray-on fireproofing will be applied shall be certified to be compatible with the fireproofing and UL assemblies.
- C. Sheet Steel: ASTM A653/653M, A1008/A1008M with minimum yield strength 33 ksi.
- D. Welding Materials: AWS D1.1.
- E. Shop and Touch Up Primer: SSPC 15, Type 1, grey oxide for primed deck, certified as compatible with the fireproofing and UL assemblies.

ACCESSORIES

- A. Ridge Strips, Valley Strips, Eave Strips, sound attenuation strips for acoustical deck flute fills: Fabricated of metal of same type, gage and finish as deck.

PART 3 EXECUTION

EXAMINATION

- A. Coordination: Verification of existing conditions prior to beginning work.
- B. Fabrication prior to approval of shop drawings shall be entirely at the risk of the contractor.

INSTALLATION

- A. Erect metal deck in accordance with SDI Manual and manufacturer's instructions. Deck units shall be erected in a minimum three span condition unless otherwise noted on drawings.
- B. Bear deck on steel supports with 2 1/2 inch minimum bearing. Align deck units in true straight lines. Allow for minimum 3" end laps.
- C. Fasten deck to steel support members at ends and intermediate supports with 3/4" diameter fusion puddle welds at 12 inches oc maximum. Weld spacing shall be enhanced to 6" centers within 12 feet of ridges, gable ends, and eaves.
- D. Weld in accordance with AWS D1.1.
- E. Mechanically fasten side laps at 24 inches oc maximum with #12 tek screws.
- F. Place formed steel ridge strips, eave strips, valley strips in position and mechanically attach at 6" oc.
- G. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch up zinc rich prime paint.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

SECTION INCLUDES

- A. Steel floor deck and accessories.
- B. Formed steel deck end and edge forms to contain wet concrete.

REFERENCES

- A. ASTM A36/A36M - Structural Steel.
- B. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.
- C. ASTM A653/(A653M) - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural Quality.
- D. ASTM A525 - Steel Sheet, Zinc-Coated, Galvanized by the Hot-Dip Process.
- E. ASTM A611 - Steel, Cold-Rolled Sheet, Carbon, Structural.
- F. AWS D1.1 - Structural Welding Code.
- G. FM - Roof Assembly Classifications.
- H. SDI (Steel Deck Institute) - Design Manual for Composite Decks, Form Decks, Roof Decks, Cellular Metal Floor Deck with Electrical Distribution.
- I. SSPC (Steel Structures Painting Council) - Painting Manual.
- J. UL - Fire Resistance Directory.
- K. Warnock Hersey - Certification Listings.

PERFORMANCE REQUIREMENTS

- A. Metal deck in accordance with SDI Design Manual.

SUBMITTALS FOR REVIEW

- A. Shop Drawings: Indicate deck erection piece marks on deck plan, support locations, projections, openings, welding pattern and side lap connection details and all pertinent details, and accessories.
- B. Product Data: Provide deck profile characteristics and dimensions, structural properties, and finishes.

SUBMITTALS FOR INFORMATION

- A. Certificates: Certify that Products meet or exceed specified requirements.

- B. Submit manufacturer's installation instructions.
- C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

QUALITY ASSURANCE

- A. Manufacturer and Installer: Companies specializing in performing the work of this Section with minimum five years documented experience.

DELIVERY, STORAGE, AND HANDLING

- A. Off load and handle deck in suitable manner so as not to damage deck units.
- B. Store deck on dry wood sleepers. Slope decking for positive drainage.
- C. Protect deck from damage and form accumulation of dust and debris.

PART 2 PRODUCTS

MATERIALS

- A. Deck units shall be 3" deep, 18 gage, galvanized, Type 3 VLI composite deck units as manufactured by Vulcraft products or approved equal.
- B. Sheet Steel: ASTM A653/653M Structural Quality; with G60 galvanized coating conforming to ASTM A653/653M.
- C. Welding Materials: AWS D1.1.
- D. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type I - Inorganic.

ACCESSORIES

- A. Flute Closures at ends of deck runs or change in deck direction.
- B. Provide column and beam closure plates and other closure plates as required to prevent fresh concrete leakage. Provide necessary miscellaneous framing supports around columns or other floor penetrations where required to achieve complete first class job.

FABRICATION

- A. Composite Metal Floor Deck Units shall be manufactured in accordance with SDI requirements.
- B. Related Deck Accessories: Metal closure strips, wet concrete stops, cover plates, of profile and size as required.

PART 3 EXECUTION

EXAMINATION

- A. Verification of existing conditions prior to beginning work is required.

INSTALLATION

- A. Erect metal deck in accordance with SDI Manual.
- B. Bear deck on masonry or concrete support surfaces with 3 inch minimum bearing. Align deck units to be true and straight.
- C. Bear deck on steel supports with 2 1/2 inch minimum bearing. Align deck units to be true and straight.
- D. Fasten deck units to steel support members at ends and intermediate supports with fusion welds through deck with one 3/4" diameter puddle weld. Weld in accordance with AWS D1.1.
- E. Mechanically fasten male/female side laps with TEK screws at 18 inches oc maximum. Screws to be #12 self drilling self tapping.
- G. Install sheet steel closures to close openings between deck and walls, columns, and other openings.
- H. Exercise proper care so as not to burn holes in deck and/or notch steel beam supports during the deck welding operations. Damaged deck and/or steel supports shall be removed and replaced at no additional cost to owner when directed by the Engineer.
- I. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up cold galvanizing prime paint.
- J. Provide temporary shoring at mid span prior to placing concrete where recommended by deck supplier or where deck span exceeds 10'-6". Keep shoring 1/4" below deck to allow deck to "settle" down on shoring members when shoring is used.
- K. Plan placement of concrete sequence so that the weight of the fresh concrete is placed on the top most sheet in the male female side lap first to prevent excess concrete leakage.
- L. Avoid "piling" up fresh concrete on deck. Keep maximum fresh concrete thickness as close to final thickness as possible while placing concrete to avoid damage to deck due to excessive deck deflection.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall consist of all labor and materials required to provide all miscellaneous fabricated metal items scheduled on Drawings and specified in this Section.

Miscellaneous metal items for which drawing information is fully descriptive are not necessarily named herein, but shall be provided as shown and as required.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers:

Standard: For purposes of designating type and quality for work under this Section, Drawings and Specifications are based on products manufactured or furnished by Manufacturers listed for each item.

SUBMITTALS:

Shop Drawings: Submit shop drawings in quadruplicate to Architect in accordance with GENERAL CONDITIONS for approval of all fabricated miscellaneous items. Shop drawings shall indicate following: fabrication, assembly and erection details, sizes of all members, fastenings, supports, and anchors; patterns; clearances, and all necessary connection to work of other trades.

Catalog Cuts: For standard manufactured items, catalog cuts may be submitted as specified in GENERAL CONDITIONS, providing all technical performance characteristics and other pertinent information are given.

PRODUCT HANDLING:

Handling and Storage: Handle all materials carefully to prevent damage and store at site above ground in covered, dry locations.

Replacement: Damaged items that cannot be restored to like-new conditions shall be removed and replaced at no additional cost to Owner.

PART 2: PRODUCTS

BASIC MATERIALS:

Structural Shapes: ASTM A 36/A572 Dual Certified.

Steel Pipes: ASTM A 72 welded wrought iron pipe, standard weight, Schedule 40.

Steel Tubing: ASTM A 500, Grade B.

Cast Iron: ASTM A 48j, Class 30, with minimum tensile strength of 30,000 psi.

Zinc-coated iron or Steel Sheets: ASTM A 446.

Cold-rolled Carbon Steel Sheets: ASTM A 366-66.

Exterior Lintels: ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products

Stainless Steel Sheet: Type #304

FABRICATION:

Measurements: Verify all measurements and take all field measurements necessary before fabrication.

Fasteners: Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with material to which fastenings are applied. Permanent connections shall be riveted, welded or bolted. Exposed welds shall be ground smooth and flush.

Components: Include materials and parts necessary to complete each item properly, even though such work may not definitely be shown or specified.

Provide and install miscellaneous bolts and anchors, supports, braces, and connections necessary for completion of work.

Drill or punch holes for bolts and screws. Poor matching of holes will be rejected. Conceal fastenings where practicable.

Painting and Protective Coating:

All ferrous metal, except stainless steel and galvanized surfaces, shall be properly cleaned and given one shop coat of red lead or zinc chromate primer.

Anchors built into masonry shall be coated with asphalt paint unless specified to be galvanized. Metal work to be encased in concrete shall be left unpainted unless specified or noted otherwise.

Where hot-dip galvanized or zinc-coated metal is specified or shown, it shall not be shop-primed unless specifically required otherwise for paint finish, which shall require bonderized or paint-grip primer. Recoat at all field welds and grindings, and where initial galvanized coating has been removed or deteriorated..

Galvanizing:

Hot-dip galvanizing or zinc coatings applied on products fabricated from rolled, pressed and forged steel shapes, plates, bars and strips shall comply with ASTM A 123-68.

Lintels in exterior walls shall be hot dip galvanized to ASTM A123 G60 standards after fabrication.

Exterior handrails shall be hot dip galvanized to ASTM A123 G60 standards after fabrication.

MISCELLANEOUS ITEMS:

Supplementary Structural Steel: All structural framing incorporated in building design and detailed on Architectural Drawings, but not shown on Structural Steel Drawings, shall be furnished as part of miscellaneous metal work.

Miscellaneous Lintels, Shelf Angles, Beams and Plates, Brackets: Provide miscellaneous lintels and shelf angles, beams, plates, and brackets as indicated.

Lintels shall have 8" bearings at each end unless shown otherwise.

Weld or bolt members together where so indicated, to form complete composite assembly. Set beams on plates as indicated.

Where shelf angles are attached to concrete with bolts and adjustable inserts, provide slotted holes of proper size and spacing in vertical leg of shelf angles.

Miscellaneous Fasteners: Furnish all bolts, nuts, anchor bolts, plates, anchors, ties, clamps, hangers, nails, spikes, screws, straps, toggle and expansion bolts, and other items of rough hardware of sufficient size and number to tie together various parts of building and secure all of its parts in place. Such miscellaneous items shall be of same material as metals they contact.

Supports, Bracing:

Furnish and install all bracing and suspension type supports, fastened to structure, for following and additional conditions, as may be required.

1. Exterior soffits
2. Head of exterior doors and window wall

Handrails: Provide pipe handrails as detailed, fabricated from 1-1/2 I.D. pipe. Weld all joints and grind smooth. Fabricate entire assembly carefully in accordance with details. After installation, use wire brush, sand blast, or otherwise treat to provide completely smooth surface for application of paint. Wall handrail consist of straight sections of black steel pipe, mounted on wall brackets. Install brackets with approved anchoring device. Close ends with molded end closures.

All exterior handrails shall be hot dipped galvanized, exposed not requiring finish painting. All welds and grindings to be recoated on site with a field applied galvanizing coating to match.

Ladders: Where indicated vertical wall mounted interior ladders shall be 20" wide, fabricated with 3/8"x 1-1/2" hot-rolled rails and 3/4" round steel rungs extending through rails with connection welds, provided at all roof hatch locations. Space rungs 12" o.c. Anchor ladders at bottom and top. Brackets shall be of same size as side rails and of such length as to hold ladder 7" away from wall.

Fold-out Escape Ladder: Provide prefabricated extruded aluminum and stainless steel fold-out escape ladder on utility platforms where indicated on Drawings, rated for 1000 lbs., 6060-T6 high-grade aluminum, pull out release pin, see Drawings. "MODUM Fire Escape Ladder". Accessories include egress ladder signage, acrylic sign panels as indicated on drawings.

PART 3: EXECUTION

WORKMANSHIP:

Ferrous metal surfaces shall be clean and free from mill scale, flake rust and rust pitting; well formed and finished to shape and size, with sharp lines and angles and smooth surfaces.

Castings shall be of uniform quality, free from blow-holes, porosity, hard spots, shrinkage distortion or other defects. Castings shall be smooth and well cleaned by shot-blasting or other approved method. Covers subject to street or foot traffic shall have machined horizontal bearing surfaces. Provide machined bearing or contact surfaces for other joints where indicated or required.

COORDINATION: At proper time, deliver and set in place items of metal work to be built into adjoining construction.

PAINTING: Finish painting of items not factory painted shall be as specified in Section 09900.

STEEL FRAMED STAIRS:

GENERAL: Construct stairs to conform to sizes and arrangements shown; joint pieces together by welding unless otherwise indicated. Provide complete stair assemblies including metal framing, hangers, columns, railings, newels, balusters, struts, clips, brackets, bearing plates and other components necessary for the support of stairs and platforms and as required to anchor and contain the stairs on the supporting structure. Certify with drawings bearing the seal of an N. C. Registered Engineer indicating capacity to support 100 p.s.f. uniform live load or 300 pound concentrated load as required by code.

STAIR FRAMING: Fabricate stringers of structural steel channels, or plates, or a combination thereof, as shown. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as shown. Bolt or weld headers to strings and newels and framing members to strings and headers; fabricate and join so that bolts, if used, do not appear on finish surfaces.

METAL PAN RISERS, SUBTREADS, AND SUBPLATFORMS: Shape metal pans for risers and subtreads to conform to configuration shown. Provide minimum 12 gage thickness of structural steel sheet for metal pans indicated but not less than that required to support total design loading.

Form metal pans of hot-rolled or cold-rolled carbon steel sheet, unless otherwise indicated.

Attach risers and subtreads to stringers by means of brackets made of steel angles or bars. Weld brackets to strings and attach metal pans to brackets by welding, riveting or bolting.

Provide subplatforms of configuration and construction indicated, or if not indicated, of same metal as risers and subtreads and in thickness required to support design loading. Attach sub platform to platform framing members with welds.

SPIRAL STAIRS: Design and construct stairs to conform to arrangements shown; joint pieces together by welding unless otherwise required by the approved design. Provide complete stair assemblies including metal framing, hangers, columns, treads, risers, railings, newels, balusters, struts, clips, brackets, bearing plates and other components necessary for the support of stairs and platforms and as required to anchor and contain the stairs on the supporting structure. Design to comply with the latest NC Building code requirements. Certify with drawings bearing the seal of an N. C. Registered Engineer indicating capacity to support 100 p.s.f. uniform live load or 300 pound concentrated load as required by code.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall be to provide expansion control joint covers as shown on Drawings and specified in this Section.

Building expansion joints with joint covers specified (walls, floors and ceilings) are required at all locations where enclosed connectors meet building units.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section, refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers:

Standard: For purpose of designating type and quality for work under this Section, Drawings and Specifications are based on products manufactured by the C/S Group Company. Other Manufacturers who can furnish products or systems of same materials specified and equal in all respects will also be acceptable, such as Architectural Art Mfg., Balco, Inc., and M M Systems.

SUBMITTALS:

Manufacturer's Data: Submit three (3) copies of folder containing complete Manufacturer's data and installation procedures for all products to be used in work of this Section.

Shop Drawings: Submit Shop Drawings in compliance with GENERAL CONDITIONS. These drawings shall be coordinated with adjacent work.

PRODUCT HANDLING:

Working Areas: Provide suitable areas for storage of materials and equipment.

Delivery: Deliver products to site in original sealed containers or packages bearing Manufacturer's name and brand designation.

PART 2: PRODUCTS

FLOOR JOINT COVERS: Balco, Inc. Model 75FPE-1. Coordinate with finish floor material. Floor to floor units to be complete with extruded aluminum frames, center plates and cover plates extruded from 6063T5 alloy. Frames to be anchored to slab with 1/4" (6.25 mm) diameter expansion bolt anchors. Flexible vinyl expansion filler. Floor joints to be coordinated to provide alignment with wall and ceiling expansion joint covers. All aluminum surfaces in contact with masonry shall receive a shop coat of zinc chromate primer.

WALL JOINT COVERS: C/S Group Model AFW Series. Extruded aluminum cover plates and snap-lock anchor clips to be 6063-T52 alloy. Cover plate to be supplied with continuous duroflex seal. Snap-lock anchor shall be secured 24" O.C., complete with serrations to assure positive adjustable anchorage. Finish shall be satin clear anodize, prime coat for field painting, Medium , dark Bronze or Kynar 500 colors, to be selected by Architect to suit condition of use.

CEILING JOINT COVERS: C/S GROUP MODEL FC OR FCFC Series. Cover shall be aluminum and dual durometer P.V.C. The vertical legs shall be a rigid material for positive anchoring. The exposed gaskets shall be a flexible P.V.C. to allow for expansion and contraction of the joint cover. Color to be white.

Provide joint cover at all areas abutting existing building.

PART 3: EXECUTION

INSPECTION

Examine all surfaces to which products are scheduled to be installed. If unsatisfactory conditions exist, report to General Contractor and do not proceed with work until conditions have been satisfactorily corrected.

INSTALLATION

Install expansion joint covers at locations indicated on Architectural and / or Structural Drawings and at all locations where enclosed connectors meet building units, in accordance with Manufacturer's printed instructions and Shop Drawings, approved by Architect.

All installations shall be performed by capable workmen under direction of foreman fully qualified by experience in each respective field of installation work.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall consist of all labor and materials required to provide all rough carpentry work scheduled on Drawings and specified herein.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Section 01068.

CODE COMPLIANCE:

All framing to comply with the current edition of the Building Code having jurisdiction in North Carolina.

QUALITY ASSURANCE:

Manufacturers:

Standard: For purposes of designating type and quality of work under this Section, drawings and Specifications are based on products manufactured or furnished by Manufacturer listed for each product.

COORDINATION WITH OTHER TRADES: Coordinate locating of nailers, furring, grounds, and similar supports for other trades so that installation of finish work may be properly executed to fulfill design requirements.

MOISTURE CONTENT OF LUMBER: Maximum moisture content for lumber products shall be 19 percent on air dried stock, and 15 percent maximum on kiln-dried (KD) stock.

DRESSED LUMBER: Surface lumber four sides (S4S) unless specified otherwise for particular products.

DELIVERY AND STORAGE: As soon as materials are delivered to site, place under cover and protect properly from weather. Do not store or erect material in wet or damp portions of buildings or in areas where plastering or similar work is to be executed until such work has been completed and has become reasonably dry.

PART 2: PRODUCTS

FRAMING LUMBER

Various materials for framing shall be of sizes shown and shall conform to Grading Standards of SPIB. All framing material shall be #2 SYP.

Where indicated on the Drawings, provide FRT Fire Retardant Treated lumber.

PLYWOOD or ORIENTED STRAND BOARD MATERIALS: Softwood plywood or OSB sheathing shall conform to requirements of U. S. Product Standard PS 1-66, Construction and Industrial. All plywood or

OSB sheathing which has any edge or surface permanently exposed to weather shall be "EXTERIOR" type.

Where indicated on the Drawings, provide FRT Fire Retardant Treated plywood.

Where indicated on the Drawings, provide PT Preservative Treated plywood.

PRESERVATIVE TREATED WOOD PRODUCTS: Protective pressure treatment of lumber or products shall be .40 pcf retention of chromated copper arsenate as produced by Wolman, Osmose, Boliden or approved equal. Material shall be treatment grade marked, for ground contact, kiln dried not to exceed 19%, and all cut ends shall be coated with the same preservative, at job site during construction.

All lumber products in contact or fastened to concrete, concrete masonry or brick masonry to be preservative treated wood products.

FASTENING DEVICES: Anchors and fasteners for securing wood items, unless noted otherwise, shall meet following requirements:

Bolts:

- Bolts, nuts, studs and rivets shall conform to Federal Specifications FF-B-571a and FF-B-575, as applicable.
- Lag screws or lag bolts: Federal Specification FF-B-561b.
- Toggle Bolts: Federal Specification FF-B-588b.
- Screws: Federal Specification FF-S-111b.
- Nails and Staples: Federal Specification FF-N-105a.

All fastening devices used in exterior or concrete construction shall be hot-dip galvanized.

All fastening devices used in Fire Retardant Treated or Preservative Treated lumber and plywood to be corrosion resistant per manufacturer's recommendations.

Ground Anchorage: Wood plugs or nailing blocks are not acceptable for fastening grounds, furring, or blocking to concrete or masonry. Hardened steel nails, expansion screws, toggle-bolts, metal plugs, or metal inserts, as most appropriate for each type of masonry or concrete construction shall be used.

Explosive-Driven Fastenings: Explosive or powder-driven fastenings may be used only when approved by Architect.

PART 3: EXECUTION

GENERAL REQUIREMENTS FOR FRAMING AND BRACING:

Finish: Unless otherwise indicated, use S4S lumber for all framing members.

Size: Unless otherwise indicated, framing shall conform to nominal size requirements shown on Drawings.

Space framing on 16 inch centers, unless shown otherwise on Drawings.

Install required blocking, bracing, or other framing required for support of built-in equipment,

including casework.

INSTALLATION OF WOOD GROUNDS:

Location: Install permanent and temporary wood grounds as indicated for proper execution of work of all trades. Remove temporary grounds when no longer required.

Fastening: Except as otherwise required for special locations, form grounds of kiln-dried southern yellow pine, 1-1/2 inches wide, and of thickness to properly align related items of work. Securely fasten grounds into position by means of nails, brads, bolts, or other methods that will provide maximum results.

Coordination: Coordinate locations, sizes and fastenings of grounds with work of other trades. When grounds are to provide backing for fastening of grilles, fixtures, louvers, and similar items of work, exercise care in installation of grounds to provide for correct installation of those other items of work.

INSTALLATION OF WOOD BLOCKING:

Location: Install all wood blocking required to provide anchorage for other materials. Form to shapes and sizes as indicated or as may be required to accomplish particular installation. Form blocking of sizes shown or of minimum 2 inch thick nominal material.

At location of wall mounted equipment install 2"x 8" blocking unit between properly located studs at height indicated in Finish Hardware Schedule, or where indicated for wall mounted equipment. Install wood blocking behind all cabinets and toilet accessories as required.

Steel: Blocking in conjunction with steel work shall be bolted to steel with bolts, washers and nuts, countersunk where required.

Roofing: Form blocking in conjunction with gravel stops and built-up roofs to shapes as detailed. Anchor with countersunk bolts, washers and nuts.

Anchorage: Wedge, anchor and align blocking to provide rigid and secure installation of both blocking and other related work.

INSTALLATION OF WOOD FURRING:

Location: Provide all free-standing, suspended, solid-anchored, and other types of wood furring as required for receipt, alignment and complete installation of various types of finishing materials.

Spacing: Space furring members as required. Provide headers and other nailing members within furring framework. Install with faces true to line and plumb, using wood shims as necessary.

Fastening: Install furring into position by whatever means required to provide secure, rigid, and correct installation. When necessary, use nailing plugs, power-actuated anchors, toggle bolts, anchor bolts, washers and nuts, nails, and similar fastenings.

CLEANING UP: At completion, remove all excess materials and all debris resultant from operations of work of this Section. Leave entire work in neat, clean condition, satisfactory for receipt of other related items of work to be installed as part of work of other Sections.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall include furnishings all labor and materials required to provide all finish carpentry and millwork, as scheduled on Drawings and as specified herein.

Work Included This Section:

All finish carpentry, cabinetwork, and millwork, as identified on Drawings, which shall include, but not necessarily be limited to the following:

1. Cabinets (base and wall hung)
2. Interior wood trim and paneling.
3. Work Counters
4. Shelves and Slatwall
5. Hanging all wood doors as scheduled. Doors will be fabricated prefit.

Furnish all millwork and cabinet work, deliver to building, assemble, level, secure to floors and/or walls, as shown on Drawings, equipment schedule, Specifications, and processed Shop Drawings.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Section 01068.

AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI), except as otherwise indicated.

QUALITY CONTROL:

Millwork Contractor shall be approved by Architect on basis of quality of work performed during at least 10 years of manufacturing, capability to meet requirements of these specifications, reputation of performing satisfactory work on time, and completion of at least three satisfactory installations of projects of comparable size.

SUBMITTALS:

Shop Drawings: Submit shop drawings in accordance with GENERAL CONDITIONS on all items fabricated for this Project. Shop Drawings shall locate all grounds, blocking, and other anchoring devices required to properly secure the work.

Do not fabricate millwork until final Shop Drawings have been processed by Architect. Reviewing and processing shop drawings by Architect does not relieve Contractor of checking and verifying job dimensions and conditions required by details on processed Shop Drawings and Contract Drawings.

Reviewing and processing shop drawings by Architect does not authorize changes. No changes will be made without explicit written authorization.

Samples: Submit samples of following items for approval by Architect prior to preparation of Shop Drawings and deliver to Project Site.

- Submit complete and current plastic laminate colors and patterns sample chain from Formica, that includes samples of all standard and premium textures and patterns options.
- Submit complete laminate colors/pattern/textures chains from Formica, Nevamar, and Wilsonart, chains from all three manufacturers, for Architect to select from.
- Submit complete and current colors and patterns sample chain of PVC edgeband.
- Cabinet door and drawer, showing constructions.
- Shelving Wood trim countertop and backsplash (plastic laminate clad)

PRODUCT HANDLING:

Delivery: Do not deliver millwork items to job site until building is sufficiently conditioned to prevent damage by moisture, dampness, excessive humidity, extreme dryness, extreme heat or cold.

Storage: Store millwork in enclosed areas having same temperature and humidity conditions as areas in which millwork will be installed.

Damaged Items: Remove from site immediately all items damaged due to improper handling or storage.

ENVIRONMENTAL CONDITIONS:

Building Conditions: Install millwork only when normal temperature and humidity conditions approximate interior conditions that will exist when building is occupied.

Glazing shall be in place, and all exterior openings closed. All concrete, plastering, and other wet work shall be completed and dry.

Heat and Ventilation shall be provided to maintain proper conditions before, during and after completion of installing casework.

FIELD MEASURING AND COORDINATION:

Before fabrication begins, inspect and field measure all areas to receive work, as follows:

Field measure areas where the work is to be installed.

Field coordinate with adjacent electrical and data outlet locations, and adjacent equipment locations, prior to rough-in of electrical devices.

PART 2: PRODUCTS

MATERIALS:

General: Except as otherwise indicated, comply with following requirements for architectural woodwork not specifically indicated as prefabricated or prefinished standard products.

Wood Moisture Content: Provide kiln-dried (KD) lumber with an average moisture content range of 9% to 13% for exterior work and 6% to 11% for interior work. Maintain temperature and relative humidity during fabrication, storage and finishing operations so that moisture content values for woodwork at time of installation do not exceed the following:

Interior Wood Finish: 8% - 113% for damp regions (as defined by AWI).

Interior Wood for Transparent Finish:

Solid Wood: Plain-sawn premium clear red oak.

Plywood: Plain sliced premium clear red oak.

Plastic Laminate: Comply with NEMA LD-3 for type (vertical and horizontal grades), thickness, color, pattern, finish and textures indicated for each application, or if not indicated, as selected by the Architect from the manufacturer's complete line of colors and patterns, and from the manufacturer's complete line of standard and premium textures options.

Manufacturer:

Standard: For purpose of designating type and quality for plastic laminate work under this Section, Drawings and Specifications are based on products manufactured by Formica.

The basis of design is Formica's complete line of plastic laminate colors and patterns, including all of Formica's complete line of standard and premium textures options.

Submit complete and current laminate color/patterns/textures sample chains from Formica, Nevamar, and Wilsonart, all three manufacturers, for Architect to choose from.

Provide exterior grade plywood or water-resistant resin impregnated composition board countertops at all locations with a sink. Use CD exterior grade veneer plywood, fabricated with water resistant glues and adhesives.

Quality Standards: For following types of architectural woodwork; comply with indicated standards as applicable:

Casework and Countertops: AWI Section 400.

Shelving: AWI Section 600.

Design and Construction Features: Comply with details shown for profile and construction of architectural woodwork; and, where not otherwise shown, comply with applicable Quality Standards, with alternate details as Fabricator's option.

Solid Surface Countertops and Benches: Where Corian Solid Surface countertops or benches are indicated on Drawings, provide 1/2" Corian or equal solid surfacing material. Architect to select from manufacturer's full range of colors and patterns.

Laminated Slatwall Paneling: Where indicated on Drawings, provide 3/4 inch thick medium density fiberboard paneling, laminated with high pressure laminate, grooved to receive standard-sized fixture mounting brackets for display. Color to be selected from panel manufacturer's standard options. Grooves shall be lined with powder coated extruded aluminum inserts, color selected by Architect.

Slatwall Display Accessories: Where indicated on Drawings, provide 4 rows of 12" deep x 3/4" thick melamine slatwall shelving, with all necessary shelf brackets, for complete shelving assemblies. Provide

(2) 25-count packs of assorted slatwall peg hooks; one pack with assorted 2", 4", 6" sizes, and one pack with assorted 8", 10", 12" sizes.

INTERIOR ARCHITECTURAL WOODWORK:

Wood Casework, Transparent Finish or Plastic Laminate Clad

AWI Section: 400

Grade: Custom, with book matching of adjoining leafs with transparent finish

Construction: Reveal Overlay.

CABINET HARDWARE AND ACCESSORY MATERIALS:

Hardware Standards: Except as otherwise indicated, comply with ANSI A 156.9 "American National Standard for Cabinet Hardware". Millwork Contractor to provide slides, dual hinges, catches, standards, brackets, locks, and pulls as shown and required.

Drawer and Door Pulls: Hafele No. 151.33.203, cast aluminum, brushed finish.

Catches: Heavy-duty roller ball catches.

Catches for Tall Cabinet Door Pairs: EPCO Heavy-Duty Elbow Catch, spring-loaded, in bright nickel finish, manufactured in solid brass, with slotted screw adjustment holes.

Locks for Tall Teachers Cabinets: Provide pin & tumbler master keyed cam locks, for each tall teacher cabinet, dull chrome finish.

Hinges: Reveal overlay, 5-knuckle, non-removable pin, institutional hospital type, brushed nickel finish, by Terry or Rockford Process Control, or equivalent.

Shelf Clips: Allen Field heavy-duty polycarbonate double pin shelf locking support, secures and supports 1" shelving.

Edge Band: 3mm PVC unless indicated otherwise, exposed or concealed.

Unless otherwise noted, all edges shall be banded with 3mm PVC, with all PVC edges eased with a radius.

Shelving Edge Band: Provide 3mm PVC edgebanding of shelves on front and rear edges only, with 1mm PVC edgebanding on remaining two side support edges.

Countertop Support Bracket: Wall mounted bracket, powder coated A-36 steel angle, 3/8" thick x 2.5" with beveled edges, with integral steel gusset. Mount with masonry expansion anchors at masonry support wall. Equivalent to model Front Mounting PLUS Brackets by Centerline Brackets.

Glass shall be Grade A, double strength, where scheduled.

Stainless steel sinks will be furnished and installed by Plumbing Contractor in countertop openings provided by Millwork Contractor.

PART 3: EXECUTION

INSPECTION OF SURFACES:

Inspection: Before installation begins, inspect all areas to receive work, as follows:

Field measuring areas where the work is to be installed.

For any deficiency which might prevent satisfactory installation of cabinetwork, millwork, or hanging wood doors, including coordination with adjacent electrical and data outlet, and adjacent equipment locations.

For presence and proper positioning of grounds and other anchoring devices built into work as required by approved millwork Shop Drawings.

Acceptance of Surfaces: Do not start fabrication or work until deficiencies of surfaces to receive work have been corrected. Beginning of installation in any area shall constitute acceptance of that area as satisfactory to receive this work, and shall constitute acknowledgement that all areas have been field measured, and all coordination with adjacent systems have been performed. Contractor shall be fully accountable for final results and workmanship specified herein.

INSTALLATION:

Cabinetwork:

Install all cabinetwork in place, level, plumb, and accurately scribed and secured to wall and/or floor, as shown on Shop Drawings approved by Architect.

Wall cabinets shall be fastened using 1/4" diameter lag bolts in lead shields with chrome finish washers @ 24" maximum spacing, minimum of 4 anchors per wall hung cabinet section, 2 anchors across top and 2 anchors across bottom.

Base cabinets shall be fastened using 1/4" diameter lag bolts in lead shields @ 24" maximum spacing, minimum of 4 anchors per cabinet section.

Installation shall be complete, including all trim and fillers required.

At completion of installation leave all cabinets clean and free of defects.

Wood Doors:

Hang all wood doors according to Door Schedule and Shop Drawings approved by Architect.

Leave each door neatly hung, swinging easily, and performing all functions intended by finish hardware schedule.

CLEANUP: At completion of all Finish Carpentry, Cabinetwork and Millwork installations clean up all areas in which work was performed and leave ready for installation of related work.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall consist of furnishing all labor and materials required to insulate exterior CMU/brick cavity walls, exterior stud/brick cavity walls, interior stud walls, foundations, interior ceilings, and acoustical sound tubes all as shown on Drawings and as specified herein.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Section 01068.

QUALITY ASSURANCE:

Extent of insulation work is shown on drawings and indicated by provisions of this section.

Applications of insulation specified in this section include the following:

- Foundation wall board insulation (supporting backfill).
- Foamed-In-Place CMU Cell Insulation
- Spray Applied Polyurethane Insulation (interior and exterior)
- Ceiling fiberglass blanket Insulation.
- Sound Attenuation Batt Insulation
(install at all interior metal stud / gypsum wallboard partitions)

QUALITY ASSURANCE:

Thermal Conductivity: Thicknesses indicated are for thermal conductivity (k-value at 75 degrees F or 24 degrees C) specified for each material. Provide adjusted thicknesses as directed for equivalent use of material having a different thermal conductivity. Where insulation is identified by "R" value, provide thickness required to achieve indicated value.

SUBMITTALS:

Product Data: Submit manufacturer's product specifications and installation instructions for each type of insulation and vapor barrier material required.

PRODUCT HANDLING:

General Protection: 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.

PART 2: PRODUCTS

FOUNDATION / CAVITY WALL INSULATION:

Extruded Polystyrene Board Insulation: Rigid, closed-cell, extruded polystyrene insulation board with integral high-density skin and tongue and groove edges; complying with FS HH-I514, Type IV, min. 20 psi compressive strength, k-value of 0.20; 0.3% maximum water absorption; 1.1 perm-inch max. water vapor transmission; manufacturer's standard lengths and widths.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work included, but are not limited to, the following:

Manufacturer: Subject to compliance with requirements, provide products of one of the following:

- Dow Chemical Co., Midland, MI (Styrofoam SM)
- UC Industries/U.S. Gypsum; Chicago, IL (Foamular)

Mechanical Anchors: Type and size shown or, if not shown, as recommended by insulation manufacturer for type of application and condition of substrate.

Adhesive Mastic: Type, size and spacing for each condition as recommended by insulation manufacturer for type of application and condition of substrate.

Mastic Sealer: Type recommended by insulation manufacturer for bonding edge joints between units and filling voids in work.

FOAMED-IN-PLACE CMU INSULATION:

Foamed-In-Place CMU Cell Fill Insulation:

Fire-rated, Class A, thermal and acoustical amino-plast foam insulation equivalent to Core-Fill 500 manufactured by Tailored Chemical Products. Two component system of an amino-plast resin and a catalyst foaming agent. Provide at locations where indicated. Pressure injected through a series of 5/8" to 7/8" holes drilled into vertical columns of concrete masonry unit hollow cells, setting in 10 to 60 seconds. Repeat rows of injections up walls until all voids filled. Patch holes with 1800 psi mortar and score to resemble existing surface.

R-Value not less than 4.91 per inch. Fire Resistance Ratings: Minimum (4) hour fire resistance wall rating (ASTM E-119) for 8" and 12" CMU when used in standard (2) hour rated CMUs. Flame spread 0, ASTM E-84. Acoustical properties: STC rating 53.

SPRAY APPLIED POLYURETHANE CAVITY WALL INSULATION:

Provide labor, materials, and equipment necessary to spray-apply closed-cell polyurethane foam (SPF) insulation, air seal and water repellent treatment for cavity wall CMU throughout the Project. Not required at CMU surfaces to receive EIFS finish, and not required for below floor foundation cavity CMU walls.

Spray Polyurethane Foam Insulation shall be a seamless self-adhering spray-applied rigid polyurethane foam system, forming a membrane that seals CMU surfaces. Spray apply in liquid form, to form a seamless, thermal, moisture and air barrier and envelope across CMU to structural steel surfaces, and at wall-to-roof decking transition areas.

Application: Substrate to which insulation is applied must be clean, dry as confirmed by testing, and free of frost, ice, loose debris, or contaminants that will interfere with adhesion of the spray applied insulation.

Apply primers to surfaces where required by manufacturer's installation instructions. Spray apply to substrates when ambient air temperatures no less than 50 degrees F or as authorized by manufacturer, and when ambient humidity is within manufacturer's guideline ranges, and following all manufacturer's installation guidelines. Apply after the perimeter wall is in place, and rough-in plumbing and electrical penetrations inspections are completed.

Mask off all areas and surfaces to not to receive insulation. Upon completion, remove all overspray, and remove all masking materials. Shield the spray polyurethane foam from interior exposure with an approved thermal barrier.

Where damage occurs which violates the spray foam's air seal and moisture seal, repair as needed using specified spray polyurethane material or specified foam repair kit material.

Accessories:

Foam Repair Material: Provided by manufacturer or equivalent.

Moisture Detection Paper (MDP) Strips: MDP Strips manufactured by NCFI Polyurethanes or equivalent

Physical Characteristics and Properties: Foamed-In-Place Stud Wall Insulation shall equal or exceed the following:

- A. Core density: 1.9 – 2.2 lbs/cu.ft. per ASTM D-1622
- B. Compressive Strength: 15 psi (min) per ASTM D-1621
- C. R-Value: 6.2 (min) per inch, per ASTM C-518
- D. Moisture Vapor Transmission: < 1.0 at 2" thick
- E. Air Leakage: 0 at 1.57 psf, per ASTM E-283
- F. Surface Burning Characteristics: Flame Spread Index < 25 and Smoke Developed Index < 450 per ASTM E-84

Acceptable Products:

- A. InsulBloc by NCFI Polyurethanes, PO Box 1528, Mt. Airy, NC 27030
- B. Incylthane by Polymaster
- C. CertainTeed
- D. Or equivalent products per information submitted to and accepted by the Architect.

Quality Assurance:

- A. Insulation shall be installed per the manufacturer's printed instruction submitted to the Architect prior to the start of work.
- B. Insulation shall be installed by a contract installer who has been trained and certified by the manufacturer. The contract installer shall have not less than three (3) years experience in the trade and be properly licensed to perform the scope of work.
- C. Follow and adhere to all manufacturer's and OSHA safety guidelines.
- D. Upon completion of the installation, the contract installer shall provide 4-color infrared thermal images of all exterior wall surfaces to the Architect to confirm that the spray applied cavity insulation completely covers all surfaces required to be insulated, with the required thickness. If the thermal images show voids, the contract installer shall apply foam to correct the deficiency at no added cost to the Owner.
- E. Provide a one year product performance warranty by the manufacturer.

FOAMED-IN-PLACE STUD WALL CAVITY INSULATION:

Foamed-In Place Stud Wall Cavity Insulation shall be a seamless two-component, one-to-one by volume, self-adhering spray-applied rigid polyurethane foam system, using blowing agent HFC-245fa, and including an anti-microbial ingredient.

Application: Substrate to which insulation is applied must be clean, dry, and free of frost, ice, loose debris, or contaminants that will interfere with adhesion of the spray foam insulation. Apply primers to surfaces where required by manufacturer's installation instructions. Spray apply to substrates when ambient air temperatures are between 50 degrees F and 120 degrees F, following all manufacturer's

installation guidelines. Apply after the perimeter wall is in place, windows and doors installed, and rough-in plumbing and electrical inspections are completed. Mask off all areas not to receive insulation and release agent to stud facings to facilitate removal of foam. Remove all overspray and overfill from interior stud facings, remove all masking materials.

Accessories:

Joint Filler Foam: Hilti CF 124 Filler Foam or equivalent.

Caulk: Sikaflex 1a single component polyurethane or equivalent

Use joint filler foam and/or caulk to seal around windows, doors electrical raceways, multi-piece metal stud sill plates and headers, multiple joined studs, wall opening perimeters, etc.

Physical Characteristics and Properties: Foamed-In-Place Stud Wall Insulation shall equal or exceed the following:

- A. Core density: 1.9 – 2.5 lbs/cu.ft. per ASTM D-1622
- B. Compressive Strength: 20 – 27 psi per ASTM D-1621
- C. R-Value: 6.4 per inch (aged), per ASTM C-518
- D. Closed Cell Content: > 90% per ASTM D-2856
- E. Moisture Vapor Transmission: 0.7 at 2" thick
- F. Surface Burning Characteristics: Flame Spread Index \leq 25 and Smoke Developed Index \leq 450 per ASTM E-84

Acceptable Products:

- A. NCFI Spray Foam System 11-012 by NCFI Polyurethanes, PO Box 1528, Mt. Airy, NC 27030
- B. Bayseal CC by BaySystems
- C. Styrofoam Brand SPF Insulation by Dow Chemical Company
- D. Or equivalent products per information submitted to and accepted by the Architect.

Quality Assurance:

- A. Insulation shall be installed per the manufacturer's printed instruction submitted to the Architect prior to the start of work.
- B. Insulation shall be installed by a contract installer who has been trained and certified by the manufacturer. The contract installer shall have not less than three (3) years experience in the trade and be properly licensed to perform the scope of work.
- C. Follow and adhere to all manufacturer's and OSHA safety guidelines.
- D. Upon completion of the installation, the contract installer shall provide 4-color infrared thermal images of all exterior wall surfaces to the Architect to confirm that foamed-in-place stud wall insulation completely fills all spaces required to be insulated. If the thermal images show voids, the contract installer shall apply foam to correct the deficiency at no added cost to the Owner.
- E. Provide a one year product performance warranty by the manufacturer.

Alternative Barrier System Required in Areas Not Protected with Drywall or Masonry:

- A. Areas of Spray Foam Insulation not protected with Drywall or Masonry shall be protected with an approved intumescent covering, equal to International Fireproofing Technologies, Inc., "DC-315", spray applied 21 mils wet / 14 mils dry minimum, meeting all requirements of the NC Building Code and IRC.

CEILING INSULATION:

Unfaced Blanket-type Glass Fiber Ceiling Insulation: Inorganic non-asbestos fibers formed into semi-rigid blankets, R-11, 24" x 48" batt size. Do not insulate over lighting fixtures. Provide over all ceilings continuous, unless otherwise noted.

SOUND ATTENUATION BATT INSULATION:

Sound Attenuation Batt Insulation: Mineral wool blankets, 2 1/2" thick, manufactured by USG, USM, Owens-Corning or equal providing STC ratings scheduled. Install in strict accordance with

manufacturer's printed instructions and at all interior metal stud / gypsum wallboard partitions. Provide all necessary anchoring accessories for a complete no-sag installation.

PART 3: EXECUTION

INSPECTION AND PREPARATION:

Installer must examine substrates and conditions under which insulation work is to be performed, and must notify Contractor in writing of unsatisfactory conditions. Do not proceed with insulation work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

Clean substrates of substances harmful to insulations or vapor barriers, including removal of projections which might puncture vapor barriers.

INSTALLATION:

General:

Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.

Extend insulation full thickness as shown over entire area to be insulated. Spray, cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.

Perimeter and Under-Slab Insulation:

On vertical surfaces, set units in adhesive/mastic applied in accordance with manufacturer's instructions. Use type adhesive recommended by manufacturer of insulation.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

TYPE AND SEQUENCE OF CONSTRUCTION

New roof insulation over new steel roof deck. New roof system shall meet fire resistance Class A requirements and wind uplift resistance meeting ASTM E1592 and UL/FM I-90.

RELATED SECTIONS

07610 Metal Roofing

SUBMITTALS

Product Data:

1. Product data sheets.
2. Product samples.

DELIVERY, STORAGE, AND HANDLING

Deliver and store products according to general requirements for materials and equipment and Part 3 of this Section.

Provide unopened containers and packages with labels bearing producer(s) name and source of product and date of manufacture. Factory Mutual approval or Underwriters Laboratories Classification shall be on package.

Keep roof insulation protected while in storage; keep dry during application. Outdoors, store off ground on pallets protected with breathing type covers. Roof insulation which has been wet, and then dried, may be used only if approved by Architect.

ENVIRONMENTAL REQUIREMENTS

Install roof insulation only when surfaces are dry.

Do not install roof insulation if moisture content of substrate is above that acceptable to roof insulation and roof membrane producer.

PART 2: PRODUCTS

ROOF INSULATION

Vapor Barrier - 10 mil Polyethylene with lapped edges taped.

Product: Rigid polyisocyanurate board, with a coated glass-fiber facer conforming to or exceeding the requirements of ASTM C 1289, Type II, Class 1 / FS HH-I-1972. Compliance with FM Standard 4450/4470.

Equivalent to: ENRGY 3 Polyisocyanurate Roof Insulation, by Johns Manville
ACFOAM-II Polyisocyanurate Roof Insulation, by Atlas

Thickness: 2 layers/courses; total thickness to Match Existing

<u>Property</u>	<u>Test Method</u>	<u>Value</u>
Tensile Strength:	ASTM C209	730 psf
Thermal Resistance (LTTR):	ASTM C518	R 5.7 per inch
Water Absorption:	ASTM C209	1.0% by volume, maximum
Water Vapor Permeance:	ASTM E96	1.5 perm maximum
Dimensional Stability:	ASTM 2126	2% linear change, maximum
Maximum Operating Temperature:	ASTM D 1623	-100 F to 250 F
Product Density:	ASTM D1622	Nominal 2 pcf
Compressive Strength:	ASTM D1621	Grade 3: 25 psi minimum
Flame Spread:	ASTM E84	20-30
Smoke Developed:	ASTM E84	55-250

Referenced Standards:

Section 2603, FOAM PLASTIC INSULATION, International Building Code

ASTM: ASTM C 1289, Type II, Class 1

Underwriters Laboratories: Class A for Roof System External Flame – UL Standard 790

Insulation shall meet criteria for UL 1256 for a fire classified system.

Underwriters Laboratories: UL Construction No. 263

FM Standards 4450 / 4470

Insulation Board Joint Tape: Weather resistant self-adhering heavy-duty tape as recommended by roof insulation manufacturer.

PART 3: EXECUTION

ROOF INSULATION APPLICATION:

GENERAL

Lay roof insulation in staggered courses parallel to roof edges.

Stagger end joints of each course, both layers.

Miter roof insulation edges at ridges, valleys, and other similar non-planar conditions. Butt edges to provide moderate contact; do not smash edges. Provided in layers specified with each layer's joints taped.

PROTECTION

Protect roofing work from foot traffic and construction damage.

CLEAN UP

Remove excess materials, trash, debris, equipment, and parts from the Work.

Repair, or remove and replace, damage and stains caused by roofing work.

FIELD QUALITY CONTROL:

Protection: If work is stopped before completion of application of roof insulation and roofing, protect exposed insulation. Seal edges to prevent penetration of moisture. Do not lay more insulation in one working day than can be covered by roofing in same day.

Inspection: Architect shall be notified to inspect work after completion of vapor barrier and completion of roof insulation. If this examination discloses that work is not according to Specification, or that work has been damaged by traffic or other trades, Contractor shall agree to furnish additional materials necessary to make repairs and place work in acceptable condition.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1 GENERAL

1.01 SUMMARY

- A. Provide EIFS with Air and Moisture Barrier and Drainage for vertical above grade exterior wall substrate surfaces.
- B. The System: Provide all labor, materials and equipment necessary to install the System, complete assembly.
- C. The System consists of:
 - 1. Fluid applied Air Moisture Barrier Waterproof Coating applied to a previously installed substrate.
 - 2. Rigid PVC Starter Track with integral drainage weeps
 - 3. Expanded Polystyrene Insulation Board field adhered to a previously installed substrate.
 - 4. Woven Glass Fiber Fabric embedded in Plastic Veneer Base over Insulation Board.
 - 5. Finish Plastic Coating with integral color and texture.
 - 6. Sealants, to be provided at building expansion joints, dissimilar substrates, and dissimilar materials.
- D. RELATED SECTIONS:
 - 1. Section 09250: Sheathing
 - 2. Section 07200: Vapor Retarders
 - 3. Section 07600: Sheet Metal Flashing and Trim
 - 4. Section 07900: Sealants
 - 5. Section 08410: Exterior Entrance Doors
 - 6. Section 08418: Aluminum Storefront
 - 7. Section 08500: Exterior Windows

1.02 SUBMITTALS

- A. Manufacturer's specifications, details, installation instructions and product data.
- B. Manufacturer's code compliance report.
- C. Manufacturer's standard warranty.
- D. Applicator's certificate of instruction.
- E. Samples for approval as directed by Architect or Owner.

- F. Color samples for color selection by Architect or Owner.
- G. EPS board manufacturer's certificate of compliance with ASTM E 2430
- H. Sealant manufacturer's certificate of compliance with ASTM C 1382.
- I. Prepare and submit project-specific details.

1.03 REFERENCES

- A. ASTM Standards:
 - 1. B 117 Test Method for Salt Spray (Fog) Testing
 - 2. C 578 Specification for Preformed, Cellular Polystyrene Thermal Insulation
 - 3. C 1177 Specification for Glass Mat Gypsum for Use as Sheathing
 - 4. C 1280 Specification for Installation of Sheathing
 - 5. C 1382 Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish Systems (EIFS) Joints
 - 6. D 522 Test Methods for Mandrel Bend Test of Attached Organic Coatings
 - 7. D 882 Standard Test Methods for Tensile Properties of Thin Plastic Sheet
 - 8. D 968 Test Method for Abrasion Resistance of Organic Coatings by Falling Abrasive
 - 9. D 1382 Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish System (EIFS) Joints
 - 10. D 1784 Specification for Rigid Poly (Vinyl Chloride) (PVC) and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
 - 11. D 2247 Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
 - 12. D 2370 Test Method for Tensile Properties of Organic Coatings
 - 13. D 3273 Test for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
 - 14. E 84 Test Method for Surface Burning Characteristics of Building Materials
 - 15. E 96 Test Methods for Water Vapor Transmission of Materials
 - 16. E 108 Method for Fire Tests of Roof Coverings
 - 17. E 119 Method for Fire Tests of Building Construction and Materials
 - 18. E 283 Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen
 - 19. E 330 Test Method for Structural Performance of Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
 - 20. E 331 Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
 - 21. E 1233 Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Difference
 - 22. E 2098 Test Method for Determining Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for Use in Class PB Exterior Insulation and Finish System after Exposure to a Sodium Hydroxide Solution
 - 23. E 2134 Test Method for Evaluating the Tensile-Adhesion Performance of an Exterior Insulation and Finish System (EIFS)
 - 24. E 2273 Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish System (EIFS) Clad Wall Assemblies
 - 25. E 2430 Specification for Expanded Polystyrene (EPS) Thermal Insulation Boards for use in Exterior Insulation and Finish Systems (EIFS)
 - 26. E 2485 Standard Test Method for Freeze/Thaw Resistance of Exterior Insulation and Finish Systems (EIFS) and Water Resistive Barrier Coatings
 - 27. E 2486 Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS)

- 28. E 2570 Test Method for Water-Resistive (WRB) Coatings used Under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage
 - 29. G 153 Recommended Practice for Operating Light-and Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Nonmetallic Materials
 - 30. G 154 Recommended Practice for Operating Light-and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials
- B. Building Code Standards
- 1. Current IBC Code Edition
 - 2. AC235 Acceptance Criteria for EIFS Clad Drainage Wall Assemblies (April, 2008)
- C. National Fire Protection Association (NFPA) Standards
- 1. NFPA 268, "Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source"
 - 2. NFPA 285, "Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus"
- D. Other Referenced Documents
- 1. American Association of Textile Chemists and Colorists AATCC-127 Water Resistance: Hydrostatic Pressure Test
 - 2. GA-600 Fire Resistance Design Manual
 - 3. APA Engineered Wood Association E 30, Engineered Wood Construction Guide
 - 4. ICC-ES ESR-1748, Evaluation Report for StoTherm NExT EIFS.
 - 5. ICC-ES ESR-1233, Evaluation Report for StoGuard

1.04 DESIGN REQUIREMENTS

- A. Wind Load
- 1. Design for maximum allowable system deflection, normal to the plane of the wall, of L/240.
 - 2. Design for local wind load in conformance with code requirements.
- B. Moisture Control
- 1. Prevent the accumulation of water behind the EIF system, either by condensation or leakage through the wall construction, in the design and detailing of the wall assembly.
 - a. Provide flashing to direct water to the exterior where it is likely to penetrate components in the wall assembly, including, above window and door heads, beneath window and door sills, at roof/wall intersections, decks, abutments of lower walls with higher walls, above projecting features, and at the base of the wall.
 - b. Air Leakage Prevention-- provide continuity of air barrier system at foundation, roof, windows, doors and other penetrations through the system with connecting and compatible air barrier components to minimize condensation and leakage caused by air movement.

- c. Vapor Diffusion and Condensation-- perform a dew point analysis of the wall assembly to determine the potential for accumulation of moisture in the wall assembly as a result of water vapor diffusion and condensation. Adjust insulation thickness and/or other wall assembly components accordingly to minimize the risk of condensation. Avoid the use of vapor retarders on the interior side of the wall in warm, humid climates.
- C. Impact Resistance
 - 1. Provide ultra-high impact resistance to a minimum height of 6'-0" above finished grade at all areas accessible to pedestrian traffic and other areas exposed to abnormal stress or impact. Indicate the areas with impact resistance other than "Standard" on contract drawings.
- D. Color Selection:
 - 1. Select finish coat with a light reflectance value of 20 or greater.
- E. Joints
 - 1. Provide minimum 3/4 inch wide expansion joints in the EIFS where they exist in the substrate or supporting construction, where the EIFS adjoins dissimilar construction or materials, at changes in building height, and at floor lines in multi-level wood frame construction.
 - 2. Provide minimum 1/2 inch wide perimeter sealant joints at all penetrations through the EIFS (windows, doors, etc.).
 - 3. Provide compatible backer rod and sealant that has been evaluated in accordance with ASTM C 1382, "Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish System (EIFS) Joints," and that meets minimum 50% elongation after conditioning.
 - 4. Provide joints so that Air Barrier continuity is maintained across the joint and drain joints to the exterior.
- F. Grade Condition
 - 1. Do not install EIFS below grade (unless designed for use below grade and permitted by code) or for use on surfaces subject to continuous or intermittent water immersion or hydrostatic pressure. Provide minimum 6 inch clearance above finished grade as required by code.
- G. Trim, Projecting Architectural Features and Reveals
 - 1. All trim and projecting architectural features must have a minimum 1:2 [27°] slope along their top surface. All horizontal reveals must have a minimum 1:2 [27°] slope along their bottom surface. Increase slope for northern climates to prevent accumulation of ice/snow and water on surface. Where trim/feature or bottom surface of reveal projects more than 2 inches from the face of the EIFS wall plane, protect the top surface with waterproof base coat. Periodic inspections and increased maintenance may be required to maintain surface integrity of EIFS on weather exposed sloped surfaces. Limit projecting features to easily accessible areas and limit total area to facilitate maintenance and minimize maintenance. Refer to Sto details 1.04a and 1.04b.
 - 2. Do not use EIFS on weather exposed projecting ledges, sills, or other projecting features unless supported by framing or other structural support and protected with metal coping or flashing. Refer to Sto detail 10.61.
- I. Insulation Thickness

1. Minimum EPS insulation thickness is 1 inch.
2. Maximum EPS insulation thickness is 12 inches when installed in accordance with ESR-1748 (including architectural features).

H. Fire Protection

1. Do not use foam plastic in excess of 12 inches thick on noncombustible type construction unless approved by the code official.
2. Where a fire-resistance rating is required by code use EIFS over rated assembly (EIFS is considered to not add or detract from the fire-resistance of the rated assembly).
3. Refer to manufacturer's applicable code compliance report for other limitations that may apply.

1.05 PERFORMANCE REQUIREMENTS

Table 1—Air/Moisture Barrier Performance

TEST	METHOD	CRITERIA	RESULT
1. Water Penetration Resistance	AATCC 127 (Water Column)	Resist 21.6 in water for 5 hours before and after aging	Pass
2. Water Penetration Resistance after Cyclic Wind Loading	ASTM E 1233 / ASTM E 331	No water at exterior plane of sheathing after 10 cycles @ 80% design load and 75 minutes water spray at 6.24 psf (299 Pa) differential	No water penetration on Plywood, OSB, and Glass Mat Faced Gypsum sheathings
3. Water Resistance Testing	ASTM D 2247	Absence of deleterious effects after 14 day exposure	No deleterious effects
4. Water Vapor Transmission	ASTM E 96 Method B (Water Method)	Measure	Sto Gold Fill®*: 17.3 perms [994 ng/(Pa·s·m²)]
5. Air Leakage	ASTM E 283	<0.06 cfm/ft² (0.00030m³/s·m²)	<0.0044 cfm/ft² (0.000022 m³/s·m²)
6. Structural Integrity	ASTM E 330	2-inches H₂O pressure (positive & negative) for 1 hour.	Pass
7. Dry Tensile Strength	ASTM D 882	20 lbs/in (3503 N/m), minimum before and after aging	Sto Gold Fill:* 159 lbs/in (27845 N/m)) before aging 213 lbs/in (37302 N/m) after aging
8. Pliability	ASTM D 522	No Cracking or Delamination using 1/8" (3 mm) mandrel at 14°F (-10°C) before and after aging	Pass
9. Surface Burning	ASTM E 84	Flame Spread 0 – 25 for NFPA Class A, UBC Class I	Flame Spread: 5 Smoke Density: 10
10. Tensile Adhesion	ASTM C 297	>15 psi (103 kPa)	>30 psi (207 kPa) to Plywood, OSB, Glass Mat Faced Gypsum sheathings

* Note: Sto Gold Fill testing with Sto Detail Mesh reinforcement

Table 2—EIFS Weather Resistance and Durability Performance

TEST	METHOD	CRITERIA	RESULTS
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DIVISION 7
SECTION 07240

THERMAL AND MOISTURE PROTECTION
EXTERIOR INSULATION & FINISH SYSTEM

1. Accelerated Weathering	ASTM G 153 (Formerly ASTM G 23)	No deleterious effects* at 2000 hours when viewed under 5x magnification	Pass
2. Accelerated Weathering	ASTM G 154 (Formerly ASTM G 53)	No deleterious effects* at 2000 hours when viewed under 5x magnification	Pass @ 5000 hours
3. Freeze/Thaw Resistance	ASTM E 2485	No deleterious effects* at 10 cycles when viewed under 5x magnification	Pass @ 90 cycles
4. Water Penetration	ASTM E 331 (modified per ICC-ES AC 235)	No water penetration beyond the plane of the base coat/EPS board interface after 15 minutes at 6.24 psf (299 Pa) or 20% of design wind pressure, whichever is greater	Pass at 12.0 psf (575 Pa) after 30 minutes
5. Drainage Efficiency	ASTM E 2273	90% minimum	> 99%
6. Tensile Adhesion	ASTM E 2134	Minimum 15 psi (103kPa) tensile strength	Pass
7. Water Resistance	ASTM D 2247	No deleterious effects* at 14 day exposure	Pass @ 60 days
8. Salt Spray	ASTM B 117	No deleterious effects* at 300 hours	Pass @ 3000 hrs
9. Abrasion Resistance	ASTM D 968	No cracking or loss of film integrity at 528 quarts (500 L) of sand	Pass
10. Mildew Resistance	ASTM D 3273	No growth supported during 28 day exposure period	No growth at 42 days
11. Impact Resistance	ASTM E 2486	Level 1: 25-49 in-lbs (2.83-5.54J) Level 2: 50-89 in-lbs (5.65-10.1J) Level 3: 90-150 in-lbs (10.2-17J) Level 4: >150 in-lbs (>17J)	Pass with one layer Sto Mesh Pass with two layers Sto Mesh Pass with one layer Sto Intermediate Mesh Pass with one layer Sto Armor Mat and one layer Sto Mesh

*No deleterious effects: no cracking, checking, crazing, erosion, rusting, blistering, peeling or delamination

Table 3—EIFS and Air/Moisture Barrier Fire Performance

TEST	METHOD	CRITERIA	RESULT
1. Fire Endurance	ASTM E 119	Maintain fire resistance of existing rated assembly	Pass*

2. Intermediate Scale Multi-Story Fire Test	NFPA 285 (UBC Standard 26-9)	1. Resistance to vertical spread of flame within the core of the panel from one story to the next 2. Resistance to flame propagation over the exterior surface 3. Resistance to vertical spread of flame over the interior surface from one story to the next 4. Resistance to significant lateral spread of flame from the compartment of fire origin to adjacent spaces	Pass with 12 inches of EPS insulation *
3. Radiant Heat Ignition	NFPA 268	No ignition @ 20 minutes	Pass with 12 inches of EPS insulation
4. Surface Burning (individual components)	ASTM E 84	Individual components shall each have a flame spread of 25 or less, and smoke developed of 450 or less	Flame: 0 Smoke Developed: 5

Note: * indicates results based on extrapolation of data from series testing. ASTM E119 testing performed on assembly with 4 inch thick EPS.

Table 4—EIFS Component Performance

TEST	METHOD	CRITERIA	RESULT
1. Alkali Resistance of Reinforcing Mesh	ASTM E 2098	Greater than 120 pli (21 dN/cm) retained tensile strength	Pass
2. Requirements for Rigid PVC Accessories	ASTM D 1784	Meets cell classification 13244C	Pass

1.06 QUALITY ASSURANCE

A. Manufacturer requirements

1. Member in good standing of the EIFS Industry Members Association (EIMA).
2. System manufacturer for a minimum of twenty-five (25) years.
3. Manufacturing facilities ISO 9001:2000 Certified Quality System.
4. Manufacturer's wall assembly listed in Gypsum Association Fire Resistance Design Manual.

B. Contractor requirements

1. Engaged in application of EIFS for a minimum of three (3) years.
2. Knowledgeable in the proper use and handling of Sto materials, possessing certificate of completion for on-line Sto EIFS application test.
3. Employ skilled mechanics who are experienced and knowledgeable in EIFS application, and familiar with the requirements of the specified work.
4. Successful completion of minimum of three (3) projects of similar size and complexity to the specified project.
5. Provide the proper equipment, manpower and supervision on the job site to install the system in compliance with Sto's published specifications and details and the project plans and specifications.

- C. Insulation board manufacturer requirements
 - 1. Recognized by Sto as capable of producing insulation board to meet system requirements, and hold a valid licensing agreement with Sto.
 - 2. Listed by an approved agency.
 - 3. Label insulation board with information required by Sto, the approved listing agency and the applicable building code.
- D. Mock-up Testing
 - 1. Construct full-scale mock-up of typical EIFS/window wall assembly with specified tools and materials and test air and water infiltration and structural performance in accordance with ASTM E 283, E 331 and E 330, respectively, through independent laboratory. Mock-up shall comply with requirements of project specifications. Where mock-up is tested at job site maintain approved mock-up at site as reference standard. If tested off-site accurately record construction detailing and sequencing of approved mock-up for replication during construction.
- E. Inspections
 - 1. Provide independent third party inspection where required by code or contract documents.
 - 2. Conduct inspections in accordance with code requirements and contract documents.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver all materials in their original sealed containers bearing manufacturer's name and identification of product.
- B. Protect coatings (pail products) from freezing and temperatures in excess of 90°F (32°C). Store away from direct sunlight.
- C. Protect Portland cement based materials (bag products) from moisture and humidity. Store under cover off the ground in a dry location.

1.08 PROJECT/SITE CONDITIONS

- A. Maintain ambient and surface temperatures above 40°F (4°C) during application and drying period, minimum 24 hours after application of Air/Moisture barrier and EIFS.
- B. Provide supplementary heat for installation in temperatures less than 40°F (4°C).
- C. Provide protection of surrounding areas and adjacent surfaces from application of materials.

1.09 COORDINATION/SCHEDULING

- A. Provide site grading such that EIFS terminates above finished grade a minimum of 6 inches or as required by code.
- B. Coordinate installation of foundation waterproofing, roofing membrane, windows, doors and other wall penetrations to provide a continuous air and moisture barrier.
- C. Provide protection of rough openings before installing windows, doors, and other penetrations through the wall.

- D. Coordinate installation of windows and doors so air barrier components are connected to them to provide a continuous air barrier.
- E. Install window and door head flashing immediately after windows and doors are installed.
- F. Install diverter flashings wherever water can enter the wall assembly to direct water to the exterior.
- G. Install copings and sealant immediately after installation of the EIF system and when EIFS coatings are dry.
- H. Attach penetrations through EIFS to structural support and provide water tight seal at penetrations.

1.10 WARRANTY

- A. Provide manufacturer's standard warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide Air/Moisture Barrier, EIF System and accessories from single source manufacturer or approved supplier, equivalent to StoTherm Essence NExT.
- B. The following are acceptable manufacturers:
 - 1. Sto Corp.--Air/Moisture Barrier, EIF System
 - 2. Plastic Components, Inc.--Accessories

2.02 AIR/MOISTURE BARRIER

- A. StoGuard
 - a. Joint Compound: Sto Gold Fill—ready mixed flexible joint compound for rough opening protection and joint treatment of wall sheathing (not required for concrete/masonry surfaces).
 - b. Waterproof Coating: Sto Gold Coat®—ready mixed waterproof coating for wall substrates and sheathings.

2.03 ADHESIVE (select one)

- A. Cementitious Adhesives
 - 1. Sto Primer/Adhesive--acrylic based adhesive mixed with portland cement (for use over exterior glass mat faced gypsum sheathing (compliant with ASTM C 1177), exterior cementitious sheathing, concrete, masonry or cement plaster surfaces.
 - 2. Sto Primer/Adhesive-B--one component polymer modified cement based, factory blend adhesive (for use over exterior glass mat faced gypsum sheathing (compliant with ASTM C 1177), exterior cementitious sheathing, concrete, masonry or cement plaster surfaces.

2.04 INSULATION BOARD

- A. Nominal 1.0 lb/ft³ (16 kg/m³) Expanded Polystyrene (EPS) insulation board in compliance with ASTM E 2430 and ASTM C 578 Type I requirements

2.05 BASE COAT (select one)

- A. Cementitious Base Coats
 - 1. Sto Primer/Adhesive--acrylic based base coat mixed with portland cement.
 - 2. Sto Primer/Adhesive-B—one component polymer modified cement based factory blend base coat.
- C. Waterproof Base Coat
 - 1. Sto Flexyl—two component fiber reinforced acrylic based waterproof base coat mixed with portland cement *(for use as a waterproof base coat for foundations, parapets, splash areas, trim and other projecting architectural features)*.

2.06 REINFORCING MESHES

- A. Standard Mesh
 - 1. Sto Mesh--nominal 4.5 oz./yd² (153 g/m²), symmetrical, interlaced open-weave glass fiber fabric made with alkaline resistant coating for compatibility with Sto materials *(achieves Standard Impact Classification)*.
- B. High Impact Mesh
 - 1. Sto Intermediate Mesh--nominal 11.2 oz./yd² (380 g/m²), high impact, interwoven, open weave glass fiber fabric with alkaline resistant coating for compatibility with Sto materials *(achieves High Impact Classification)*.
- C. Ultra-High Impact Mesh
 - 1. Sto Armor Mat--nominal 15 oz./yd² (509 g/m²), ultra-high impact, double strand, interwoven, open-weave glass fiber fabric with alkaline resistant coating for compatibility with Sto materials *(recommended to a minimum height of 6'-0" [1.8m] above finished grade at all areas accessible to pedestrian traffic and other areas exposed to abnormal stress or impact. Achieves Ultra-High Impact Classification when applied beneath Sto Mesh)*.
- D. Specialty Meshes
 - 1. Sto Detail Mesh--nominal 4.2 oz/yd² (143 g/m²), flexible, symmetrical, interlaced glass fiber fabric, with alkaline resistant coating for compatibility with Sto materials *(used for standard EIFS backwrapping, aesthetic detailing, and reinforcement of sheathing joints and protection of rough openings with air/moisture barrier)*.

2.07 PRIMER (select one)

- A. Sto Primer Sand—acrylic based tinted primer with sand for roller application.
- B. Sto Primer Smooth – acrylic based tinted primer for spray application.

2.08 FINISH COAT

- A. Sto Essence DPR Finish —acrylic based textured wall coating with graded marble aggregate.
- B. Finish coat with a light reflectance value of 20 or greater.

2.09 JOB MIXED INGREDIENTS

- A. Water--Clean and potable.
- B. Portland cement--Type I, Type II, or Type I-II in conformance with ASTM C 150.

2.10 ACCESSORIES

- A. Starter Track— Rigid PVC (polyvinyl chloride) plastic track Part No. STDE as furnished by Plastic Components, Inc., (800 327-7077), or equivalent.
- B. Soffit Vent—Where indicated, provide 4" wide perforated aluminum soffit vent, Model SV-50-400/EIFS by Frye Reglet Corporation. 6063 T5 aluminum, clear anodized finish.

2.11 MIXING

- A. Sto Gold Fill--mix with a clean, rust-free high speed mixer to a uniform consistency.
- B. Sto Gold Coat-mix with a clean, rust-free high speed mixer to a uniform consistency.
- C. Sto Primer/Adhesive: mix ratio with portland cement is 1:1 by volume. Pour Sto Primer/Adhesive into a clean mixing pail. Add portland cement, mix to a uniform consistency and allow to set for approximately five minutes. Adjust mix if necessary by adding up to 8 fl. oz. (0.24L) of water per pail and remix to a uniform trowel consistency. Avoid retempering. Keep mix ratio consistent.
- D. Sto Primer/Adhesive-B: mix ratio with water: 5-6.5 quarts (4.7-6.2 L) of water per 50 pound (23 kg) bag of Sto Primer/Adhesive-B. Pour water into a clean mixing pail. Add Sto Primer/Adhesive-B, mix to a uniform consistency and allow to set for approximately 5 minutes. Adjust mix if necessary by adding up to 12 fl. oz. (0.35L) of water per bag and re-mix to a uniform trowel consistency. Avoid re-tempering. Keep mix ratio consistent. Do not exceed maximum amount of water in mix ratio.
- E. Sto RFP--mix with a clean, rust-free high speed mixer to a uniform consistency.
- F. Sto Flexyl--mix ratio with portland cement: 1:1 ratio by weight. Pour Sto Flexyl into a clean mixing pail. Add portland cement, mix to a uniform consistency and allow to set for approximately five minutes. Adjust mix if necessary with additional Sto Flexyl and remix to a uniform trowel consistency. Avoid retempering. Keep mix ratio consistent.
- G. Sto primer--mix with a clean, rust-free high speed mixer to a uniform consistency.
- H. Sto Essence DPR Finish --mix with a clean, rust-free high speed mixer to a uniform consistency. A small amount of water may be added to adjust workability. Limit addition of water to amount needed to achieve the finish texture
- I. Mix only as much material as can readily be used.
- J. Do not use anti-freeze compounds or other additives.

PART 3 EXECUTION

3.01 ACCEPTABLE INSTALLERS

- A. Prequalify under Quality Assurance requirements of this specification (section 1.06 B).

3.02 EXAMINATION

- A. Inspect surfaces for:
1. Contamination—algae, chalkiness, dirt, dust, efflorescence, form oil, fungus, grease, laitance, mildew or other foreign substances.
 2. Surface absorption and chalkiness.
 3. Cracks—measure crack width and record location of cracks.
 4. Damage and deterioration.
 5. Moisture content and moisture damage—use a moisture meter to determine if the surface is dry enough to receive the EIFS and record any areas of moisture damage.
 6. Compliance with specification tolerances—record areas that are out of tolerance (greater than ¼ inch in 8-0 feet deviation in plane).
- B. Inspect sheathing application for compliance with applicable requirement:
1. Glass Mat Faced gypsum sheathing compliant with ASTM C 1177.
 2. Exterior Grade and Exposure I wood based sheathing—APA Engineered Wood Association E 30
 3. Cementitious sheathing--Consult manufacturer's published recommendations
- C. Report deviations from the requirements of project specifications or other conditions that might adversely affect the Air/Moisture Barrier and EIFS installation to the General Contractor. Do not start work until deviations are corrected.

3.03 SURFACE PREPARATION

- A. Remove surface contaminants on concrete and concrete masonry surfaces.
- B. Apply conditioner by sprayer or roller to chalking or excessively absorptive surfaces.
- C. Replace weather-damaged sheathing and repair damaged or cracked surfaces.
- D. Level surfaces to comply with required tolerances.
- E. Repair cracks, spalls or damage in concrete or concrete masonry surfaces.

3.04 INSTALLATION

- A. Air/Moisture Barrier

For installation over exterior or Exposure I Plywood, and Glass Mat Faced Gypsum Sheathing in compliance with ASTM C 1177:

1. Protect rough openings, joints and parapets: apply Sto Gold Fill joint compound by trowel over rough openings, sheathing joints, inside and outside corners, and tops of parapets. Immediately embed reinforcing mesh in the wet joint compound and trowel smooth. Embed minimum 4 inch wide mesh at sheathing joints and minimum 9 inch wide mesh at rough openings, inside and outside corners and tops of parapets (refer to Sto detail 10.23a for detailed information on proper protection of rough openings and sequencing of work at rough openings).
2. Spot fasteners with Sto Gold Fill joint compound.

3. Apply waterproof coating by roller over sheathing surface, including the dry joint compound, to a uniform wet mil thickness of 10 mils in one coat. Use ½ inch nap roller for plywood and gypsum sheathing. Use ¾ inch nap roller for glass mat faced gypsum sheathing. Protect from weather until dry.
4. Coordinate installation of connecting air barrier components with other trades to provide a continuous air tight membrane.
5. Coordinate installation of flashing and other moisture protection components with other trades to achieve complete moisture protection such that water is directed to the exterior, not into the wall assembly, and drained to the exterior at sources of leaks (windows, doors and similar penetrations through the wall assembly).

For Installation over Exposure I OSB (Oriented Strand Board) sheathing:

1. Apply waterproof coating with a ¾ inch nap roller to sheathing surface to a uniform wet mil thickness of 10 mils. Protect from weather until dry. Then follow steps 1-5 above.

For Installation over Concrete or Concrete Masonry Unit (CMU) surfaces: (Void and Pinhole Free Surface Required)

1. Repair cracks up to 1/8 inch wide with Sto Gold Fill. Rake the crack with a sharp tool to remove loose or friable material and blow clean with oil-free compressed air. Apply Sto Gold Fill by spray, trowel or putty knife over the crack and tool surface smooth. For cracks wider than 1/8 inch up to ¼ inch wide, use a paintable acrylic latex caulk to fill crack, tool flush, and allow to dry. (*Note: For moving cracks or cracks larger than ¼ inch, consult with a structural engineer for repair method*). Protect repair from weather until dry.
2. Liberally apply two coats of Sto Gold Coat to the surface with a ¾ inch nap roller or spray equipment to a minimum wet thickness of 10 mils each and up to a total maximum of 30 mils depending on surface condition. Additional coats may be necessary to provide a void and pinhole free surface. Protect from weather until dry.
3. For "rough" CMU wall surfaces, skim coat the entire surface with a cementious leveler, equivalent to Sto Leveler, Sto BTS®Plus, Sto BTS® Silo, or Sto BTS® Xtra, before application of Sto Gold Coat. Protect from weather until dry.
4. Coordinate installation of connecting air barrier components with other trades to provide a continuous air tight membrane.
5. Coordinate installation of flashing and other moisture protection components with other trades to achieve complete moisture protection such that water is directed to the exterior, not into the wall assembly, and drained to the exterior at sources of leaks (windows, doors and similar penetrations through the wall assembly).

B. Starter Track

1. Strike a level line at the base of the wall to mark where the top of the starter track terminates.
2. Attach the starter track even with the line into the structure a maximum of 16 inches on center with the proper fastener: Type S-12 corrosion resistant screws for steel framing with minimum 3/8 inch penetration, and galvanized or zinc coated nails for wood framing with minimum 3/4 inch penetration. Attach between studs into blocking as needed to secure the track flat against the wall surface. For solid wood sheathing or concrete/masonry surfaces, attach directly at 12 inches on center maximum.

3. Butt sections of starter track together. Miter cut outside corners and abut. Snip front flange of one inside corner piece (to allow EPS Board to be seated inside of track) and abut.
 4. Install Starter Track at other EIF System terminations as designated on detail drawings: above roof along dormers or gable end walls, and beneath window sills with concealed flashing.
- C. Splice Strips for Starter Track and Flashing
1. Starter Track, Window/Door Head Flashing and Side Wall Step Flashing: install 2 inch wide diagonal splice strips of detail mesh at ends of head flashings. Install minimum 4 inch wide splice strips of detail mesh between back flange of starter track, head flashings and roof/side wall step flashing. Center the mesh so it spans evenly between the back flange of the Starter Track or flashing and the sheathing. Embed the mesh in the wet joint compound and trowel smooth.
 2. Apply waterproof coating over the splice strip when the joint compound is dry (refer to Sto Details 10.00 and 10.23b).
- D. Backwrapping
1. Apply a strip of detail mesh to the dry air/moisture barrier at all system terminations (windows, doors, expansion joints, etc.) except where the Starter Track is installed. The mesh must be wide enough to adhere approximately 4 inches of mesh onto the wall, be able to wrap around the insulation board edge and cover a minimum of 2 ½ inches on the outside surface of the insulation board. Adhere mesh strips to the air/moisture barrier and allow them to dangle until the backwrap procedure is completed (paragraph I.1). Alternatively, pre-wrap terminating edges of insulation board.
- E. Adhesive Application and Installation of Insulation Board (*for all adhesives except Sto BTS Silo*)
1. Rasp the interior lower face of insulation boards to provide a snug friction fit into the Starter Track. (*Note: rasping prevents an outward bow at the Starter Track*).
 2. Apply adhesive to the back of the insulation board with the proper size stainless steel notched trowel. Apply uniform ribbons of adhesive parallel with the SHORT dimension of the board so that when boards are placed on the wall the ribbons will be VERTICAL. Apply adhesive uniformly so ribbons of adhesive do not converge.
 3. Immediately place insulation boards in a running bond pattern on the wall with the long dimension horizontal. Start by inserting the lower edge of the boards inside the starter track at the base of the wall until they contact the bottom of the track. Apply firm pressure over the entire surface of the boards to ensure uniform contact of adhesive. Bridge sheathing joints by a minimum of 6 inches. Interlock inside and outside corners.
 4. Butt all board joints tightly together to eliminate any thermal breaks in the EIFS. Prevent any adhesive from getting between the joints of the boards.
 5. Cut insulation board in an L-shaped pattern to fit around openings. Do not align board joints with corners of openings.
 6. Remove individual boards periodically while the adhesive is still wet to check for satisfactory contact with the substrate and the back of the insulation board, and for spacing between ribbons of adhesive. An equal amount of adhesive must be on the substrate and the board when they are removed, as an indication of adequate adhesion. Do not use nails, screws, or any other type of non-thermal mechanical fastener.
- F. Adhesive Application and Installation of EPS Board with StoSilo Spray Equipment

1. Apply Sto BTS Silo material to the prepared sheathing to a rough thickness of 1/4". Form uniform vertical ribbons of adhesive by directing the proper size stainless steel notched trowel from the bottom of the wall upward. Immediately install insulation boards in accordance with steps E.3-E.6 above. If adhesive develops a "skin" before the insulation board is installed remove the adhesive and replace with fresh material.
- G. Slivering and Rasping of Insulation Board Surface
1. After insulation boards are firmly adhered to the substrate, fill any open joints in the insulation board layer with slivers of insulation or spray foam. Use spray foam that is identified by the spray foam manufacturer as suitable for this use.
 2. Rasp the insulation board surface to achieve a smooth, even surface and to remove any ultraviolet ray damage.
- H. Trim, Reveals and Projecting Aesthetic Features
1. Attach features and trim where designated on drawings with adhesive to the insulation board or sheathing surface. Slope the top surface of all trim/features minimum 1:2 (27°) and the bottom of all horizontal reveals minimum 1:2 (27°).
 2. Cut reveals/aesthetic grooves with a hot-knife, router or groove-tool in locations indicated on drawings.
 3. Offset reveals/aesthetic grooves minimum 3 inches from insulation board joints.
 4. Do not locate reveals/aesthetic grooves at high stress areas such as corners of windows, doors, etc.
 5. A minimum 3/4 inch thickness of insulation board must remain at the bottom of the reveals/aesthetic grooves.
- I. Completion of Backwrapping
1. Complete the backwrapping procedure by applying base coat to exposed edges of insulation board and approximately 4 inches onto the face of the insulation board. Pull mesh tight around the board and embed it in the base coat with a stainless steel trowel. Use a corner trowel for clean, straight lines. Smooth any wrinkles or gaps in the mesh.
- J. Base Coat and Reinforcing Mesh Application
1. Apply minimum 9x12 inch diagonal strips of detail mesh at corners of windows, doors, and all penetrations through the system. Embed the strips in wet base coat and trowel from the center to the edges of the mesh to avoid wrinkles.
 2. Apply detail mesh at trim, reveals and projecting architectural features. Embed the mesh in the wet base coat. Trowel from the base of reveals to the edges of the mesh.
 3. Ultra-High impact mesh application (recommended to a minimum height of 6'-0" above finished grade at all areas accessible to pedestrian traffic and other areas exposed to abnormal stress or impact, and where indicated on contract drawings): apply base coat over the insulation board with StoSilo spray equipment or a stainless steel trowel to a uniform thickness of approximately 1/8 inch. Work horizontally or vertically in strips of 40 inches, and immediately embed the mesh into the wet base coat by troweling from the center to the edge of the mesh. Butt the mesh at seams. Allow the base coat to dry.
 4. Standard mesh application: Apply base coat over the insulation board, including areas with Ultra-High impact mesh, with StoSilo spray equipment or a stainless steel trowel to a uniform thickness of approximately 1/8 inch. Work horizontally or vertically in strips of 40 inches, and immediately embed the mesh into the wet

base coat by troweling from the center to the edge of the mesh. Overlap mesh not less than 2-½ inches at mesh seams and at overlaps of detail mesh. Feather seams and edges. Double wrap all inside and outside corners with minimum 2-½ inch overlap in each direction. Avoid wrinkles in the mesh. The mesh must be fully embedded so that no mesh color shows through the base coat when it is dry. Re-skim with additional base coat if mesh color is visible.

5. Sloped Surfaces: for trim, reveals, aesthetic bands, cornice profiles, sills or other architectural features that project beyond the vertical wall plane more than 2 inches apply waterproof base coat with a stainless steel trowel to the weather exposed sloped surface and minimum four inches (100 mm) above and below it. Embed standard mesh or detail mesh in the waterproof base coat and overlap mesh seams a minimum of 2-½ inches.
6. Allow base coat to thoroughly dry before applying primer or finish.

K. Primer application

1. Apply primer evenly with brush, roller or proper spray equipment over the clean, dry base coat and allow to dry thoroughly before applying finish.

L. Finish Coat Application

1. Apply finish directly over the base coat or primed base coat when dry. Apply finish by spraying or troweling with a stainless steel trowel, depending on the finish specified. Follow these general rules for application of finish:
 - a. Avoid application in direct sunlight.
 - b. Apply finish in a continuous application, and work to an architectural break in the wall.
 - c. Weather conditions affect application and drying time. Hot or dry conditions limit working time and accelerate drying. Adjustments in the scheduling of work may be required to achieve desired results; cool or damp conditions extend working time and retard drying and may require added measures of protection against wind, dust, dirt, rain and freezing. Adjust work schedule and provide protection.
 - d. Do not install separate batches of finish side-by-side.
 - e. Do not apply finish into or over sealant joints. Apply finish to outside face of wall only.
 - f. Do not apply finish over irregular or unprepared surfaces, or surfaces not in compliance with the requirements of the project specifications.

3.05 PROTECTION

- A. Provide protection of installed materials from water infiltration into or behind them.
- B. Provide protection of installed materials from dust, dirt, precipitation, freezing and continuous high humidity until they are fully dry.

3.06 CLEANING, REPAIR AND MAINTENANCE

- A. Clean and maintain the Exterior Insulation and Finish System (EIFS) for a fresh appearance and to prevent water entry into and behind the system. Repair cracks, impact damage, spalls or delamination promptly.
- B. Maintain adjacent components of construction such as sealants, windows, doors, and flashing, to prevent water entry into the wall assembly.

- c. Refer to Manufacturer's Repair and Maintenance Guide for detailed information on EIFS restoration - cleaning, repairs, recoating, resurfacing and refinishing, or re-cladding.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1 - GENERAL

RELATED WORK SPECIFIED ELSEWHERE:

07610 Metal Roofing

DESCRIPTION OF WORK:

Contract work of this Section shall include, but not be limited to providing following:

All sheet metal work required for complete assemblies of items specified at all areas indicated on Drawings:

- Gutters
- Downspouts
- Copings
- All sheet metal work required for moisture control
- Metal valley flashing
- Metal base and counterflashings

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Section 01068.

Standards: Workmanship and methods employed for forming, anchoring, cleating, and expansion and contraction of sheet metal work shall conform to application details and description as indicated in current edition of Architectural Sheet Metal Manual, published by Sheet Metal and Air Conditioning Contractors National Association, Inc. and hereinafter referred to as "SMACNA Manual", unless otherwise noted on Contract Drawings or specified herein.

QUALITY ASSURANCE:

Manufacturers:

Standard: For purposes of designating type and quality for the work under this Section, Drawings, and Specifications are based on products manufactured or furnished by Manufacturers listed under PRODUCTS.

SUBMITTALS:

Shop Drawings: Submit for approval in accordance with GENERAL CONDITIONS.

Details and layout shall show weights, gauges or thicknesses of sheet metal, joints, expansion joint spacing, and procedures to be followed during installation. Indicate bolt size and spacing, nailers or blocking required to be furnished by others for securing work of this Section.

Catalog Cuts: For Standard manufactured items, catalog cuts may be submitted as specified in GENERAL CONDITIONS.

Guarantee: Installation of all items of this Section shall be guaranteed to be leak-free for period of five years from date of acceptance of project. Any repairs or replacements required to maintain waterproof installation shall be done at no cost to Owner.

PRODUCT HANDLING:

Handling and Storage: Damaged items that cannot be restored to like-new condition shall be removed and replaced at no additional cost to Owner.

PART 2 - PRODUCTS

MATERIALS:

Flatwork, Flashings, Copings, Gutters and Gravel Stops: Pre-finished 24 gauge galvalume steel sheet, 0.5 ounces/square foot, minimum yield of 50,000 PSI.

Gutter: 24 gauge pre-finished galvalume gutter. Provide pre-finished gutter spacers and brackets as shown on Drawings.

Finish: Premium fluorocarbon coating produced with Kynar 500 or Hylar 5000 resin

Downspouts: Downspouts, 20 gauge pre-finished galvalume, Kynar 500 finish, with downspout wall mounting brackets as per Drawings. Wall mounting brackets shall be matching material.

ACCESSORIES:

General: Provide all accessories or other items essential to completeness of sheet metal installation, though not specifically shown or specified. All such items shall be of same material or compatible to base material to which applied and gauges shall conform to SMACNA Manual recommendations.

Fasteners: All screws, bolts, rivets and other fastenings for sheet metal, unless otherwise noted, shall be like material and of size and type suitable for intended use, stainless where indicated.

Sealant: Elastomeric polyurethane gun-grade sealant equal to Sikaflex NP-1 or NP-2. Clean all sheet metal surfaces prior to application with xylene and prime with Primer equal to Sikaflex 733 primer. Follow manufacturer's written product installation guidelines, recommendations and instructions. Color to be selected by Architect.

PART 3 - EXECUTION

CONDITION OF SURFACES:

Proper Surfaces: Surfaces to which sheet metal and flashing are applied shall be even, smooth, sound, thoroughly clean and dry and free from projections or other defects that would affect application. Defects shall be corrected by trades involved before installation of sheet metal work.

INSTALLATION:

Workmanship: Fabricate and install sheet metal with lines, arises, and angles sharp and true, and plane surfaces free from waves warps, or buckles, match existing work unless shown otherwise. Exposed edges of sheet metal shall be folded back to form 1/2 inch wide hem on side concealed from view. Finished work shall be free from water leakage under all weather conditions.

Fastenings: Unless otherwise indicated or specified, all fastenings shall be concealed. Installation of and joints of all sheet metal work, including fascia claddings, shall be in accordance with recommendations of SMACNA.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

1.01 DESCRIPTION

A. General

1. Furnish all labor, material, tools, equipment, and services for a complete roofing and wall panel system, and soffit panel system to include all flashing, curbs, gutters and downspouts as indicated, in accordance with provisions of Contract Documents.
2. Completely coordinate with work of all other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
4. See Division 1 for General Requirements.

B. Related work specified elsewhere:

1. Aluminum Composite Panels: Section 07415
2. Flashing and Sheet Metal: Section 07600.
3. Drawings Building Code Summary

1.02 QUALITY ASSURANCE

A. Applicable standards:

1. SMACNA: "Architectural Sheet Metal Manual" Sheet Metal and Air Conditioning Contractors National Association, Inc.
2. AISC: "Steel Construction Manual" American Institute of Steel Construction.
3. AISI: "Cold Form Steel Design Manual," American Iron and Steel Institute.
4. ASTM A792-AZ50: Specifications for steel sheet, aluminum-zinc alloy coated (galvanized) by the hot dip process, general requirements (galvalume).
5. Underwriters Laboratories Inc. wind uplift classification UL 90
6. 2000 International Building Code, Table 1604.5, Classification Of Buildings And Other Structures For Importance Factors, Category II Seismic, Snow and Wind Factors.
7. 2000 International Building Code, Table 1604.5, Classification Of Buildings And Other Structures For Importance Factors, Category III Seismic, Snow and Wind Factors.
8. LEEDS NC, U. S. Green Building Council

9. Energy Star Roof Rating
10. Cool Metal Roof Coalition
11. Cool Roof Rating Council

B. Manufacturer's qualifications:

1. Manufacturer has a minimum of three years experience in manufacturing panels of this nature.

C. Installer's qualifications:

1. Installation of panels and accessories by installers with a minimum of two years experience in panel projects of this nature.

1.03 SUBMITTALS

A. Shop drawings:

1. Submit complete shop drawings and erection details to Architect for review. Do not proceed with manufacture prior to review of shop drawings. Do not use drawings prepared by Architect for shop or erection drawings.
2. Shop drawings show methods of erection, elevations, and plans of roof and wall panels, sections and details, anticipated loads, flashings, roof curbs, vents, sealants, interfaces with all materials not supplied and proposed identification of component parts and their finishes.
3. Manufacturer's Information: Describe available LEED points.
4. Certification: Manufacturer to certify that roof system submitted is in compliance with Building Category Importance Factors requirements

B. Mockups and Samples:

1. Roofing contractor to build a full-sized roof corner mockup on-site for review and approval by the Architect. Roof corner mockup to include roof metal rake intersection with eave metal gutter and fascia.
2. Submit samples and color chips for all proposed finishes.
 - a. Submit one 8 in. long sample of roof panel, including clips.
 - b. Submit one 8 in. long sample of wall panel, including clips.
 - c. Submit 3 in. x 5 in. color chip samples in all standard colors.

C. LEEDS NC: Submit certification from Manufacturer of roofing materials and accessories that products are sustainable products, listing all applicable LEED U.S. Green Building code council's credits made available by certification.

D. Warranty

1. Provide contractor's written NDL (No Dollar Limit) weathertightness warranty twenty (20) years, against leaks in roof panels arising out of or caused by ordinary wear and tear under normal weather and atmospheric conditions. Warranty coverage shall include all

curbs, flashing and miscellaneous trim and accessories. Warranty shall be non-pro-rated, signed by the metal roofing system contractor and shall provide for both labor and materials.

2. Provide manufacturer's NDL (No Dollar Limit) written warranty for twenty (20) years against perforation of metal roof panels due to corrosion under normal weather and atmospheric conditions. Warranty shall be signed by metal roofing system manufacturer and shall provide for complete replacement of panels and associated trim.
3. Provide manufacturer's NDL (No Dollar Limit) written paint film warranty for twenty (20) years on finish film integrity and color retention. The finish will not crack, check, peel, flake, or blister, or chalk in excess of ASTM 4214, number 8 rating, or fade in excess of 5 units per ASTM D 2244, under normal atmospheric conditions. Warranty shall be signed by metal roof system manufacturer.
4. Inspection and Report Services: Contractor shall retain independent third party agent who shall perform an inspection of the entire roof system and shall submit a written report to the Owner detailing all conditions requiring maintenance and repair by parties under the above warranties. Third party agent shall be a registered roof consultant (RRC) with minimum of 5 years as a registered roof consultant and 5 years of active project experience. Provide written certification of qualifications.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Obtain roofing products from local regional source, within 500 miles of project site.
- B. Delivery: Deliver panels to jobsite properly packaged to provide protection against transportation damage.
- C. Handling: Exercise extreme care in unloading, storing and erecting panels to prevent bending, warping, twisting, and surface damage.
- D. Storage: Store all material and accessories above ground on well skidded platforms. Store under water- proof covering. Provide proper ventilation to panels to prevent condensation build-up between each panel.

PART 2: PRODUCTS

2.01 MATERIALS

- A. Roof panel profile: 2 in. high x 3/4 in. wide rib x 16 in. wide striated panel.
- B. Panel style: Large batten, vertical leg, concealed fastener, standing seam, utilizing male and female rib configurations, with factory applied hot melt mastic in female rib, continuously locked together by an electrically powered mechanical seaming device during installation.
- C. Gauge: 24 gauge (UL-90 rated - Underwriters Laboratories).
- D. Substrate: Galvalume steel sheet, 0.5 ounces/square foot, minimum yield of 50,000 PSI.
- E. Recycled Content: Metal roof materials shall be 35% recycled content.

- F. Clip: Floating clip, low, 22 gauge, with factory applied mastic (UL-90 rated - Underwriters Laboratories).
- G. Texture: Smooth.
- H. Finish: Premium fluorocarbon coating produced with Kynar 500 or Hylar 5000 resin (20 year warranty).
- I. Reflectivity and Emissivity: Metal roof Panels shall be high reflectance and high remittance in accordance with Energy Star. Initial Reflectance (Galvalume Only) shall be at least 0.68 when tested with ASTM E-903. The three year aged reflectance shall be at least 0.57, when tested in accordance with ASTM E-1918 (Measured AS Solar Reflectivity, Not Visible Reflectance).
- J. Color: MATCH EXISTING.
- K. Acceptable manufacturer: MBCI; Product: BattenLok Series
- L. Acceptable optional manufacturers:
 - 1. Equivalent products by:
 - i. AEP Span
 - ii. American Building Company
 - iii. Butler Manufacturing Company
 - iv. McElroy Metal, Maxima 216
 - v. Peterson Aluminum Corporation, Tite-Loc
- M. Provide downspouts in profiles, shapes and materials as indicated on Drawings, 24 gauge and 20 gauge galvalume galvanized steel with Kynar 500 or Hylar 5000 resin finish. Provide straps, brackets and anchors in matching material as indicated on Drawings.
- N. U-Channel Gutter Bracket Strap: Provide 16-gauge prefinished galvanized U-bar channel gutter strap, factory powder coat painted to match roof.
- O. Pipe flashing shall be Dektite, or equivalent by Master Flash, Westform Metals or IPS Roofing Products.
- P. Provide roof and gutter expansion joints as indicated on Drawings, in matching Kynar 500 or Hylar 5000 resin finish.
- Q. All roof curbs are by metal roof contractor. Refer to mechanical drawings and coordinate curbs required with HVAC Contractor.
- R. Provide special rolled / radiused panels and trim where shown on drawings.
- S. Provide special shapes where shown on drawings.
- T. Metal soffit panels and trim where indicated to be 22-gauge galvalume steel, flat profile and smooth textured, with a factory KYNAR 500 finish, selected from standard colors. Provide 12 inch wide solid non-vented panels, unless otherwise noted. Soffit system shall be equivalent to Metal Roofing Systems (MRS) Flush Seam panel, or equivalent products by MBCI or Peterson. Provide soffit panels in compliance with ASTM 1592, and the Architectural Aluminum Manufacturers Association (AAMA) Specifications 1402-86 Standard Specifications for Aluminum siding, soffit, and fascia. Provide all necessary accessories and trims for complete assemblies.

- U. Self-adhering polymer modified bituminous membrane, 40 mil minimum thickness, Vycor Ice and Water Shield by W.R. Grace or equivalent products by GAF Materials Corp. or Calisle Coatings and Waterproofing. Cover entire roof surface.
- V. Sealants: 100% rubber butyl mastics / joint sealers, and Sikaflex NP-1 or NP-2 elastomeric gun-grade polyurethane sealant.

2.02 FABRICATION

- A. Material shall be in-line tension leveled prior to roll forming finished panel profile.
- B. Factory roll form panels in continuous lengths, full length of detailed runs. Field formed panels will not be accepted.
- C. Standard panel length shall be no more than 45 feet.
- D. Panel laps shall be 5" minimum.
- E. Fabricate trim, flashing and accessories to detailed profiles.
- F. Fabricate trim and flashing from same material as panel.

PART 3: EXECUTION

3.01 SURFACE CONDITIONS

- A. Examination
 - 1. Inspect installed work of other trades and verify that such work is complete to a point where this work may continue.
 - 2. Verify that installation may be made in accordance with approved shop drawings and manufacturer's instructions.
- B. Discrepancies:
 - 1. In event of discrepancy, notify Architect.
 - 2. Do not proceed with installation until discrepancies have been resolved.

3.02 INSTALLATION

- A. Install panels so that they are weathertight, without waves, warps, buckles, fastening stresses or distortion, allowing for expansion and contraction.
- B. Install panels in accordance with manufacturer's instructions and shop drawings.
- C. Provide concealed anchors at all panel attachment locations.
- D. Install panels plumb, level, and straight with seams and ribs/battens parallel, conforming to design as indicated.
- E. Do not place scratched panels or material in the work.

- F. Metal roofing contractor is responsible for cutting and sealing all roof penetrations and installations of all curbs. Refer to plumbing and mechanical drawings. Coordinate roof penetrations and curbs required with Plumbing and HVAC Contractors.
- G. Install self-adhering polymer modified bituminous membrane ice and water shield, to cover entire roof surface.

3.03 CLEANING, PROTECTION

- A. Dispose of excess materials and remove debris from site.
- B. Clean work in accordance with manufacturer's recommendations.
- C. Protect work against damage until final acceptance. Replace or repair to the satisfaction of the Architect, any work that becomes damaged prior to final acceptance.
- D. Scratched panels or scratched flat surfaces will not be accepted. Scratched materials shall be replaced with new matching material at contractor's expense. Repainting to conceal surface scratches will not be accepted.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK :

Work of this Section shall require furnishing all labor and materials to provide sealants, non-rated caulking, fire-rated fire caulking, and related primers, including expansion joint fillers, interior and exterior, as shown on Drawings and as specified in this Section.

Caulking and primers required for installation of all work included in Sections for Window Wall, Storefront Systems shall be part of work under that Section and shall be done in accordance with the applicable portions of this Section.

Acoustical caulking for installation of gypsum board is specified in Section 09250.

Required applications of sealants and caulking include, but are not necessarily limited to, following general locations:

- Flashing reglets and retainers.
- Metal roofing
- Coping Members, Bed and Joints.
- Interior and exterior wall joints around doors and windows perimeters.
- Exterior wall crack control joints
- Horizontal and vertical interior CMU wall and structural steel joints
- Joints at penetrations of walls, decks and floors by piping and other services and equipment.
- Fire-rated penetrations of walls, decks and floors by piping and other services and equipment.
- Concrete walk and pavement expansion joints
- Exposed interior concrete floor slab control joints

Required applications of joint fillers and gaskets include, but are not necessarily limited to, the following general types of work and locations:

- Expansion joint fillers in structural concrete.
- Exterior wall expansion joint fillers.
- Fire-rated pipe and conduit through penetrations.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Section 01068.

ASTM E 814 (UL 1479) Standard Tests of Penetration Firestop Systems

ASTM E 1966 (UL 2079) Standard Test Method for Fire Resistive Joint Systems

UL - Underwriters Laboratory

ASTM C 920

Comply with 21 CFR 177.2600 for sealants in contact with food.

LEED SC, U. S. Green Building Council

SCAQMD - South Coast Air Quality Management District

QUALITY ASSURANCE:

Manufacturers:

Standard: For purposes of designating type and quality for the work under this Section, Drawings and Specifications are based on products of Sonneborn BASF Corporation and 3M Corporation.

Source: Products for use on this Project shall be of one Manufacturer, unless noted specifically otherwise.

All sealants shall comply with requirements of the South Coast Air Quality Management District (SCAQMD) Rule #1168.

SUBMITTALS:

Manufacturer's Data: For information only, submit 2 copies of Manufacturer's specifications, installation instructions and recommendations for each type of material required. Include Manufacturer's published data, certifications or laboratory test reports indicating that each material complies with requirements. Show by transmittal that copy of instructions and recommendations has been distributed to installer.

Submit applicable UL Tested Assemblies for each type of fire-rated through penetration and fire-stopping required.

Certifications: Submit written certifications that all primers, backings, and caulking materials are chemically compatible with each other and with the overcoating or topcoating materials.

Submit environmental certifications from Manufacturers of all joint sealant materials products, listing all applicable LEED credits made available by certifications.

Samples:

Caulking and Sealants: Submit samples of interior and exterior caulking compounds and related sealants required for installation. Install 12" samples in the work on site in locations requested by the Architect, for review.

Joint Fillers and Gaskets: Submit 3, 12" long samples of each joint filler or gasket which will be reviewed by Architect for color and texture only. Compliance with all other requirements is exclusive responsibility of Contractor.

Guarantee: Furnish Owner, in care of Architect, guarantee in accordance with requirements of General Conditions for period of three (3) years from date of acceptance of project against defective workmanship and materials, warranting airtightness and water tightness of exterior sealant and installation. Repairs shall be made promptly or material replaced after proper notice at no additional cost to Owner.

PRODUCT HANDLING:

Store and handle materials in strict compliance with Manufacturer's instructions.

Store in original containers until ready for use. Damaged material will be rejected and shall be removed from site.

PART 2: PRODUCTS

JOINT BACKING MATERIAL:

Non-Traffic Joints: Except where otherwise specified, packing shall be closed-cell expanded polyethylene cord or square rod conforming to ASTM D 1752, or closed-cell vinyl type conforming to ASTM D 1667, Grade VE-41.

Floor Joints: Packing shall be closed cell neoprene cord or square rod conforming to ASTM C 509-66T, with minimum shore "A" hardness of 45.

Fire-Rated Through Penetrations: non-combustible rock wool type mineral wool.

NON-RATED CAULKING COMPOUNDS /SEALANTS

Interior Joints: Caulking, other than where sealant is called for, shall be a solvent free, low modulus, one-part silyl-terminated polyether, non-sag sealant. Tack free time shall be minimum 90 minutes. Material shall be butyl-free skinning type, paintable within one hour.

Latex sealants are restricted to use only in non-moving joints in drywall construction.

Sonolastic 150 VLM manufactured by Sonneborn, or approved equal, with 7.24% of post-consumer material recycled content, VOC (volatile organic content) of 2 g/L.

TF-100 self-leveling 100% polyurea control joint filler, for interior exposed and bare concrete floor slab control joints; for Boiler and Mechanical rooms, custodial spaces. Not for use under VCT or carpeting adhered type floor finishes.

Exterior Joints: Caulking for exterior joints other than where other sealant is called for, shall be gun-grade elastomeric polyurethane: Including but not limited to windows and storefronts perimeters, brick and masonry crack control joints, and uses on metal roofing.

Sikaflex NP-1 for walls and metal roofing, with 5% of post-consumer material recycled content, VOC (volatile organic content) of 43 g/L. Joint movement capable 35% minimum.

Sikaflex NP-2 for walls and metal roofing, with 5% of post-consumer material recycled content, VOC (volatile organic content) when mixed of 53-80 g/L. Joint movement capable 25% minimum.

Sonolastic SL-1 or SL-2 for concrete expansion joints in non-vehicular traffic areas, with 5% of post-consumer material recycled content, VOC (volatile organic content) maximum of 104 g/L.

Sonomeric 1 for concrete expansion joints in vehicular traffic areas, with 5% of post-consumer material recycled content, VOC (volatile organic content) maximum of 128 g/L.

Approved equivalent products by Tremco or Pecora are acceptable.

PRIMER:

Type: Primer, where required by Sealant Manufacturer, shall be solution or compound designed to insure adhesion of sealant and shall be compatible with sealant.

Source: Material shall be provided by Sealant or Caulking Manufacturer and shall be selected for compatibility with sealant, with substrate and shall be non-staining.

PRODUCT COMPATIBILITY: All primer, backing, and caulking materials shall be chemically compatible with each other for use as an assembly, and with all surfaces in contact with these materials.

FIRE BARRIER SEALANTS

All fire caulk sealants used for fire barriers shall have been tested and passed the criteria of ASTM E 814 (UL 1479) Standard Tests of Penetration Firestop Systems, ASTM E 1966 (UL 2079) Standard Test Method for Fire Resistive Joint Systems and CAN/ULC-S115 Standard Method of Fire Tests of Firestop Systems. All fire caulk sealants shall meet the requirements of the IBC, IRC, IPC, IMC, NFPA 5000, NEC (NFPA 70), NFPA 101 and NBCC. All fire caulks shall be listed in a tested and published through penetration UL assembly.

3M Fire Barrier Sealant FD 150+: one-component, gun grade, latex based elastomeric sealant. Paintable and repairable; firestops construction joints, and through penetrations. Not acceptable for use with CPVC pipe. VOC (volatile organic content) of <250 g/L.

3M Fire Barrier Silicone Sealant 2000+: one-component, gun grade, natural cure silicone elastomer based sealant; firestops dynamic construction joints, through penetrations, static construction joints, and blank openings. Non-paintable. VOC (volatile organic content) of <32 g/L.

3M Fire Barrier Sealant CP 25WB+: High-performance, one-component, gun-grade, latex-based, intumescent sealant. Paintable, firestops and seals single or multiple through penetrations, blank openings, and static construction joints. Not acceptable for use with CPVC pipe. VOC (volatile organic content) of <1 g/L.

3M Fire Barrier Water Tight Sealant 3000WT: High-performance, one-component, neutral cure, intumescent silicone sealant. Fully cured acts as barrier to water leakage, repairable, firestops single and multiple through penetrations, bottom-of-wall static construction joints, blank openings, VOC (volatile organic content) of <31 g/L.

Provide 3M Ultra GS Wrap Strip where required by the through penetration assembly.

PART 3: EXECUTION

Proper Surfaces: Material in contact with sealant shall be dry, full cured, and free of laitance, loose aggregate, form release agents, curing compounds, water repellents and other surface treatment that would be detrimental to adhesion of sealant.

Masonry shall be cleaned and joints raked to proper depth to receive back-up and sealant.

Concrete shall be finished joints cleaned and fins removed.

Curing: Joints in masonry, concrete and stucco work shall not be sealed until substrate has cured minimum of 28 days.

PREPARATION:

Joint Cleaning: Clean all joints thoroughly, and blow out or vacuum loose particles from joints. Surfaces with protective coatings (such as aluminum) shall be wiped with xylol or methyl ethyl ketone solvent to remove protective coatings and oil deposits.

Sheet Metal: New sheet metal shall be wiped down with copper sulphate solution or with strong acetic acid solution to etch the zinc coating and remove oil and foreign matter from surface.

Joint Design: Coordinate work of other trades so that shape of joint, dimensions, and anticipated movement shall conform to following: (Comply with manufacturer's joint design requirements)

Minimum Width: Opening not less than 1/4" wide.

Minimum Depth: Opening not less than 1/8" deep.

Maximum Movement: The width of the opening shall be at least 4 times its maximum movement.

Width Depth Ratio: Comply with manufacturer's joint design requirements. Unless otherwise required, the depth of the sealant shall be no greater than the width. Depth should be more than 1/8" and not more than 1/2" deep, unless otherwise required by manufacturer.

All caulking joints shall be recessed openings. "Fillet" type caulking into corners will not be acceptable.

Joint Packing: Packing shall be installed in all joints to receive sealant. Packing shall be sized to require 20% to 50% compression upon insertion, and placed in accordance with "Joint Design" paragraph. (In joints not of sufficient depth to allow packing, install polyethylene bond-breaking tape at back of joint). Avoid lengthwise stretching of packing material.

Masking: Apply masking tape where required to protect adjacent surfaces. Adhere tape in continuous strips in alignment with joint edge, and remove immediately after joints have been sealed and tooled.

INSTALLATION:

Application of sealants shall be as recommended by Sealant Manufacturer. Work shall be done with standard handguns or mechanical guns. Extrude sealant through nozzles of such diameter as to allow full bead of material to run into joint, but not to exceed width of joint. Force sealant into joint by tooling to insure full contact with sidewalls and backing.

Locations: Use sealants in locations hereinbefore specified for joints as specified.

Joint Finishing: Unless otherwise indicated, all joints in horizontal surfaces shall be finished flush, all joints in vertical surfaces shall be finished slightly concave in shape. Use tooling stick or knife to strike off excess material, and properly shape bead. Use xylol or toluene to prevent sealant from adhering to tooling stick. Finished bead shall be smooth, even, and free from all wrinkling, air pockets, and foreign matter.

Install expansion joint filler as recommended by Manufacturer. Filler shall be size recommended by Manufacturer for use in the expansion joint erected and shall be installed with special tool and adhesive-lubricant.

CLEAN-UP:

Excess Material: Remove all excess material adjacent to joint by mechanical means and/or with solvent (such as xylol or toluol). Leave work in neat and workmanlike manner.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work required under this Section consists of providing galvanized hollow metal doors, frames, transoms, mullions, view window frames, and related items necessary to complete work indicated on Drawings and described in these specifications. Provide galvanized steel doors and frames for all openings where reasonably inferable from plan drawings, whether specifically scheduled and detailed or not.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Section 01068.

Hollow Metal Manufacturers Association, HMMA

QUALITY ASSURANCE:

Manufacturers: Except as otherwise specified herein, all hollow metal doors and frames shall be products of one of following manufacturers, or an equal approved by Architect. Manufacturers shall be certified members of the Hollow Metal Manufacturers Association, HMMA. All doors and frames shall be from the same manufacturer.

- Amweld Bldg. Prod. Div.
- Ceco Corp.
- Curries Company
- Acme Steel Door Corporation
- Pioneer Fireproof Door Co.
- Steelcraft Mfg. Co.

SUBMITTALS:

Shop Drawings: Submit shop drawings, in accordance with GENERAL CONDITIONS, of all items specified herein to Architect for approval. Obtain approval of Drawings prior to proceeding with manufacturing. Shop drawings shall indicate following: elevations of each door type; details of each frame type; location in building for each item; conditions at openings with various wall thicknesses and materials; typical and special details of construction; methods of assembling sections; location and installation requirements for hardware; size, shape and thickness of materials; anchorage; joints and connections; and any additional pertinent information.

General Contractor shall field verify all door and frame sizes, door and frame prep requirements, and hardware prep requirements prior to fabrication.

Samples: Sample of door section indicating edge, top and/or bottom construction, insulation, hinge reinforcement and face stiffening. Sample of frame section showing welded corner joints, welded hinge reinforcements, dust covers and face finish.

PART 2: PRODUCTS

GALVANIZED METAL FRAMES: Except where otherwise scheduled, all frames for doors, shall be formed of galvanized steel to sizes and shapes indicated, to include but not limited to double and single rabbett frame profiles where indicated. Frames shall be combination type with integral trim and fabricated with full welded unit type construction at joints.

Type and Gauges of Metal: Metal for frames shall be commercial quality, cold-rolled, galvanized steel sheets, with clean smooth surfaces conforming to ASTM A 366. Except where other gauges are indicated or specified, frames shall be fabricated from steel, not lighter than following U.S. Standard gauges:

- Exterior frames - 14 gauge
- Interior frames to 3-0 in width - 16 gauge (generally)
- Interior frames over 3-0 in width - 14 gauge

Metal Reinforcements: Provide concealed metal reinforcements for hardware as required. Gauge of metal for reinforcement shall be in accordance with manufacturer's recommendations for type of hardware and the thickness and width of doors to be hung in frame, provided gauges used are not lighter than following:

- Hinge and pivot reinforcements - 7 gauge, 1-1/4"x 10" min. size.
- Strike reinforcements - 12 gauge.
- Flush bolt reinforcements - 12 gauge.
- Closer reinforcements - 12 gauge.
- Surface-mounted hardware reinforcements - 12 gauge.

Workmanship and Design: Finished work shall be strong and rigid, neat in appearance, and free from defects. Fabricate molded members straight and true, with corner joints well formed and in true alignment, and with fastenings concealed where practicable.

Forming Corner Joints: Joints for welded type frames shall be mitered and continuously arc-welded for full depth and width of frame and trim. All contact edges shall be closed tight and all welds on exposed surfaces dressed smooth and flush.

Provisions for Hardware: Wood doors shall be solid core, prefitted. Prepare frames at factory for installation of hardware. Frames shall be mortised, reinforced, drilled and tapped to templates to receive all mortised hardware; frames to receive surface-applied hardware shall be provided with reinforcing plates only. Where concealed overhead door closers are required in frame members, provide necessary additional space, cutouts, reinforcement and provisions for fastenings in heads of frames to receive closers. Provide cover boxes in back of all hardware cutouts. Punch doorframes to receive rubber door silencers; provide three (3) silencers on lock side of single doorframes and one silencer for each leaf in heads of double doorframes.

Wall Anchors: Provide metal anchors of shapes and sizes required for adjoining type of wall construction. Fabricate jamb anchors of steel, not lighter than gauge used for frame. Locate anchors on jambs near top and bottom of each frame and at intermediate points not over 24" apart.

For frames set in masonry provide 10" long, corrugated or other deformed type adjustable anchors at jambs, 4 per jamb.

For frames set in metal stud partitions weld jamb anchor clips to back of frames at jamb. Make provision for securing anchors to steel studs with 1/4" round-head machine screws, nuts and washers, or by welding. Furnish 4 anchors per jamb.

Floor Anchors: 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.

Shipment: Provide temporary steel spreaders fastened across bottom of frames; where construction will permit concealment, leave spreader in place after installation; otherwise remove spreaders after frames are set and anchored.

GENERAL REQUIREMENTS FOR GALVANIZED METAL DOORS:

Type and Gauges of Metal: Metal for doors shall be commercial quality, leveled, cold-rolled, galvanized steel sheets with clean, smooth surfaces, conforming to ASTM A 366-68. All units shall be galvanized. Gauges of face sheets shall be as specified for door types.

Hardware Reinforcements: Doors shall be mortised, reinforced, drilled and tapped at factory for fully templated hardware only, in accordance with approved hardware schedule and templates provided by Hardware Contractor. Where surface-mounted hardware is to be applied, doors shall have reinforcing plates only; all drilling and tapping shall be done by others. Steel doors for locksets shall have welded box reinforcements.

All hardware furnished by Hardware Supplier for single-acting doors shall be designed for beveled edges as specified.

Edge Profiles shall be provided on lock stiles of doors as follows:

- Single-acting swing doors - beveled 1/8" in 2".
- Opposite swing double doors - beveled 1/8" in 2".

Provide clearances as follows:

Between doors and frames; at head and jambs - 1/8".

At doorsills; where no threshold is scheduled - 3/8" maximum. Allow for carpet height where required.

At doorsills; where threshold is scheduled - 1/4" maximum between door bottom and threshold.

Between meeting stiles of pair of doors - 1/8".

Workmanship: Finish work shall rigid, neat in appearance, and free from defects. Form molded members straight and true, with joints coped or mitered, well formed, and in true alignment. All welded joints on exposed surfaces shall be dressed smooth so that they are invisible after finishing.

GALVANIZED FLUSH DOORS:

Construction: Construct doors of two outer steel sheets not lighter than 18 gauge, with edges welded and finished flush. Seams or joints will not be permitted on door faces or edges. Reinforce the outer face sheets with 20-gauge interlocking vertical channels of Z-shaped members spaced not over 6" apart and spot-welded to outer face sheets. All doors shall have galvanized steel faces and rails.

Cap tops of exterior doors to prevent the accumulation of water.

Reinforcement: Provide continuous reinforcing channels welded to face sheets at top and bottom of door. Place cork, fiberboard, or mineral wool board in spaces between reinforcing channels.

Moldings shall be not lighter than 18-gauge steel. Doors shall be prepared to receive hardware specified under HARDWARE Section.

Optional Construction: Continuous truss-formed inner core of sheet metal, not lighter than 28-gauge, may be substituted for reinforcing specified, provided it is spot-welded to face sheets every 2-3/4" horizontally and vertically over entire surface of both sides.

APPROVED FIRE DOORS AND FRAMES:

Provide approved hollow metal fire doors and frames at locations indicated in Door Schedule. Approved doors, frames and hardware shall be constructed and installed in accordance with requirements of Underwriter's Laboratories for Class of door opening indicated or specified.

Fire doors and frames which bear Underwriter's label for class of opening indicated will be only basis of acceptance.

SHOP PAINTING / GALVANIZING:

All interior and exterior doors and all interior and exterior frames shall be galvanized.

Apply primed finish to all galvanized metal surfaces furnished in this Section.

Clean and chemically treat metal surfaces to assure maximum paint adherence; follow with dip or spray coat of rust-inhibitive metallic oxide, zinc chromate, or synthetic resin primer on all exposed surfaces.

Finish surfaces shall be smooth and free from irregularities and rough spots.

Approved primer shall be compatible with finish coats specified in Section 09900.

LOCATION OF HARDWARE: Location of hardware for hollow metal doors and frames shall be as specified in Section 08700.

PART 3: EXECUTION

ERECTION:

Hollow metal shall be erected by skilled workers. Frames shall be carefully plumbed and aligned. Trim and glazing stops shall be coped or mitered with hairline fit. Brace frames until permanent anchors are set. Anchor bottoms of frames to floor with expansion bolts or with power fasteners.

In application of glazing beads, or other trim parts, exercise care to avoid running screws or other fasteners tightly enough to dimple metal.

Minor damage to metal, incurred during erection, may be repaired by filling with lead or lead alloy ground smooth and flush, if strength and appearance of finish work are not impaired, and if Architect approved. Otherwise, furnish new material.

PROTECTION AND CLEANING:

Protect doors and frames from damage during transportation and at job site. Store at site under cover on wood blocking or on suitable floors.

After installation, protect doors and frames from damage during subsequent construction activities.

Damaged work will be rejected and shall be replaced with new work.

Upon completion, metal surfaces of doors and frames shall be thoroughly cleaned, ready for paint finish by others.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART I: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall include furnishing, delivering, and storing where directed at site, the following:

Solid Core Wood Doors, as shown on drawings and specified herein. Intent of drawings and specifications is to provide all wood doors for the entire project as indicated on plans, whether specifically scheduled or not. Provide wood doors for all openings where reasonably inferable from plan drawings.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Section 01068.

SUBMITTALS:

Submit complete schedule indicating dimensions, cutouts, hardware sets, species, and other pertinent data, which references the individual architectural door mark number as shown on the plan sheets.

General Contractor shall field verify all door and frame sizes, door and frame prep requirements, and hardware prep requirements prior to fabrication.

Submit Manufacturer's data sheets, completely describing door construction, WDMA I.S. 1-A (formerly NWWDA) and AWI Classifications.

Door Supplier to submit written certification on the supplier's letterhead that the doors provided shall conform to every aspect of this specification.

Door physical finish samples shall accompany submittals. The samples will show the range of color variation.

Warranty statement shall accompany the submittal.

QUALITY ASSURANCE:

Flush wood veneer doors shall conform to the latest edition of the following standards: WDMA I.S. 1-A requirements for "Premium Grade".

Tolerances for warp, telegraphing, squareness, and prefitting dimensions as per the latest editions of WDMA I.S. 1-A, AWI Section 1300 and NFPA 80 1-11.4, 1999 edition.

Each door shall bear an identifying label indicating the manufacturer, door number and order number, as well as fire rating where applicable.

Where fire rated doors are required, provide doors labeled by ITS/Warnock Hersey International. Construction details and hardware application shall be as approved by the labeling agency.

Provide doors to meet UBC 7-2-1997 requirements for positive pressure opening assemblies in areas where this has been adopted by local authorities having jurisdiction.

MANUFACTURERS:

Standards: For purposes of designating type and quality for work under this Section, Drawings and Specifications are based on 5-ply door products meeting WDMA I.S. 1-A Premium Grade manufactured or furnished by Marshfield Door Systems.

Acceptable Manufacturers: Products of following manufacturers, meeting all requirements of these specifications, will also be acceptable.

- Marshfield
- Eggers Doors
- Oshkosh
- Algoma
- VT Industries

Samples: Sample corner section of door indicating edge, top/and/or bottom construction, core and hardware reinforcement.

Color Samples: Provide physical color samples in the veneer species specified, in the full range of manufacturer's standard colors. COLOR TO MATCH EXISTING.

Certificates: Provide certificate from manufacturer stating compliance with these specifications.

Guarantee: Provide guarantee for life of installation. Any defects noted during warranty period shall be corrected at no cost to the building Owner. Such corrective work shall include all labor and material for repair, replacement, refinishing and rehanging as required.

PRODUCT HANDLING:

Storage: Store doors at site so as to raise edges off floor and away from walls, letting air circulate freely. Store in enclosed area free from excessive heat, cold and humidity. Do not install scratched, dented or otherwise damaged doors in work.

Packaging: Door Manufacturer shall package doors in a manner to provide protection until they are installed.

Coordination: Provide Door Manufacturer with following:

- Two (2) copies of approved door schedule and Shop Drawings.
- Two (2) copies of the approved hardware schedule.
- One (1) copy of floor plan of building, showing Architect's marks and opening identification.
- Two (2) sets of templates for applicable locks, hinges and other finish hardware.

PART 2: PRODUCTS

SOLID CORE DOORS: (COLOR TO MATCH EXISTING)

Construction: Doors shall be flush type, solid core, 5-ply, Premium Grade, Type PC-5ME. Seven-ply and non-bonded core construction not accepted. Doors shall be 1-3/4" thick and shall be widths and height shown on door schedule.

Veneer: Face veneer to be plain sliced red oak, "A" grade, book and running matched, factory finished.

Finish: Doors to be factory stained and prefinished, delivered to job in protective wrapping. No doors shall be hung until finish work is complete.

Top and bottom rails shall be factory sealed with an approved sealer.

Core shall be of one piece slab, particle board, density 28-32 lb. per cu. ft. or greater bonded to stiles and rails with Type II adhesive, using high frequency method, then sanded as a unit. Meet particleboard standard ANSI A208.1, Grade 1-LD-2.

Vertical stiles shall be two piece 1 3/8" thick, with an inner stile of SCL laminated to outer 1/4" hardwood stile, matching the veneer, to provide minimum thickness after trimming of 1 3/8". Top and bottom rails shall be of structural composite lumber (SCL) construction 1 3/8" thick before prefitting. Blocking shall be provided where mortise closers or other similar devices occur.

Composite cross bands shall be applied to core prior to application of matching hardwood stiles. Exposed cross banding is not allowed along stile edges.

Veneers are to be applied to the cross banded core in a HOT PRESS using Type I exterior water resistant adhesive. Five ply construction. Exposed veneer edges are not permitted.

Openings: Factory cut openings for glass. Flush wood glass stops required for non-rated openings, species to match veneer. 20 minute rated glass kits will utilize concealed metal glass retaining clips equal or similar to VT Industries VT Fire Clip.

Openings with 088700 Security Glazing Film: Provide Metal Vision Frame #110 factory finished trim by VT Industries or equivalent for perimeter of glass openings, for wood doors receiving security glazing film.

Glass: 1/4" tempered or wire glass will be furnished and installed under Section 08800.

COMPOSITE FIRE DOORS:

Grade: WDMA I.S. 1-A, Premium, Type FD-5

Construction shall conform to Underwriter's Laboratories Class "B" 1 Hr. and 1-1/2 Hr. and Class "C" 3/4 Hr. rating requirements and shall have been tested in accordance with ASTM E 152 for fire resistance, heat transmission, and structural integrity.

Core: Core shall be calcium silicate with non-asbestos fibers, 30.8 – 34.7 lbs./ft³ nominal density, containing no asbestos. Core shall be jointed together with tongue-and-groove joints in accordance with Underwriter's Laboratories, Inc. procedure manual. Core shall be smoothly sanded prior to application of cross band and face veneer.

Edge Bands: Outer stiles are to be of same species as veneer. Inner stiles to be structural composite lumber (SCL) for 45 minute rated doors, or GP Firestop I for 60 and 90 minute rated doors which can be warranted for use with mortise butt hinges and No. 12 – 1 1/4" steel threaded-to-head screws. The door manufacturer shall drill 5/32" diameter pilot holes for all hinges.

Rails are to be structural composite lumber (SCL) for 45 minute rated doors, or GP Firestop for 60 and 90 minute rated doors, manufacturer's standard width.

Composite cross bands shall be applied to core prior to application of matching hardwood stiles. Exposed edge banding is not allowed along stile edges.

Veneers are to be applied to the cross banded core in a HOT PRESS using Type I exterior water resistant adhesive. Five ply construction. Exposed veneer edges are not permitted.

Where UBC 7-2-1997 requirements for positive pressure must be met, doors shall include all requirements as part of the door construction per "Category A" guidelines as published by ITS/Warnock Hersey. No intumescent is allowed on the frame. Only smoke gasketing applied around the perimeter of the frame to meet the "S" rating is permissible.

Vision panels and glass lights where indicated on plans, furnish and install vision panels glazed with 1/4" tempered or wire glass as indicated. Glass stops will be flush type and will utilize concealed metal glass retaining clips equal or similar to VT Industries VT Fire Clip. Where UBC 7-2-1997 requirements for positive pressure must be met, install a light kit labeled for UBC 7-2-1997 positive pressure applications to meet the appropriate fire rating.

Astragal sets, metal edges, or edge guards will not be allowed on positive pressure doors concealing intumescent within door structure.

FACTORY FINISHING: COLOR TO MATCH EXISTING

AWI, catalyzed polyurethane, premium grade. Stain coat, three coats of sealer, two polyurethane topcoats finish per AWI Section 1500. AWI Types 2 and 3 are not acceptable.

Top and bottom rails shall be factory sealed.

HARDWARE PREPARATION:

Machining: Doors shall be factory machined for application of finish hardware that required cutting of door (except surface applied hardware) including pilot holes for hinge screws and lock fronts.

Coordination: Door manufacturer shall assume responsibility of properly coordinating hardware schedule, door schedule, and hollow metal frame shop drawings and shall supply machined doors individually identified for proper openings.

LOCATION OF HARDWARE: Refer to Section 08700.

PART 3: EXECUTION

CONDITION OF SURFACES:

Frames shall be set plumb and secure before installation of doors.

Responsibility: Contractor will be held responsible for correct door frame installation. Frames out of square, cocked at bottom or bowed in or out along vertical jambs more than 1/8" shall be reinstalled.

Temperature and Humidity: Doors shall not be installed until areas of installation have temperature and humidity near that of completed building.

DOOR INSTALLATION:

Fire door installation is required to be in accordance with the NFPA 80, "Standard for Fire Doors and Fire Windows". Machined fire doors shall be provided with detailed installation instructions when doors bear a label indicating compliance to UBC 7-2-1997 or UL 10C.

Hanging: Doors shall be fitted, hung plumb, and true to within following allowable warpage tolerances: 1/4" for doors of areas 10 sq. ft. or greater, 1/8" for doors under area of 10 sq. ft. Install fire doors in accordance with NFPA Pamphlet 80 1-11.4, 1999 edition and U.L. requirements.

Non-rated clearances: Provide clearances of 1/8" at sides and top; lock edge shall have required bevel to clear frame. Provide at bottom, for specific locations, minimum adequate clearance of finish floor coverings and/or thresholds, not to exceed 3/4". Provide other undercuts as required.

Category "A" clearances between door edge and frame must be at least 1/16" and no greater than 1/8" at the head and jambs. See NFPA 80 1-11.4, 1999 edition, for clearance under door bottoms.

Factory machined doors improperly sized for opening or improperly machined for hardware by Door Manufacturer shall be rejected and returned to factory for proper replacement.

GLAZING:

Set glass against fixed molding with specific glazing compound utilizing glass retaining clips as specified.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

1.01 SUMMARY

- A. Section Includes: Aluminum Swing Doors, including:
 - 1. YKK AP Series 50D Wide Stile Swing Entrances.
 - 2. Cline Aluminum Heavy-Duty Screen Door.
- B. Related Sections:
 - 1. Glass and Glazing: Refer to Division 8 Glass and Glazing Section for glass and glazing requirements.

1.02 SYSTEM PERFORMANCE DESCRIPTION

- A. Completed assemblies shall comply with all current NC Building code requirements.
- B. Performance Requirements: Provide aluminum swing doors that comply with performance requirements indicated, as demonstrated by testing manufacturers assemblies in accordance with test methods indicated.
 - 1. Air Infiltration (Single Acting Butt Hinges or Offset Pivots): Air infiltration shall be tested in accordance with ASTM E 283 at static pressure of 1.57 PSF (75 Pa). Infiltration shall not exceed the following:
 - a. Pair of Doors: 0.18 CFM/FT (1.02 m³/h·m) of crack length.
 - b. Single Doors: 0.50 CFM/FT (2.84 m³/h·m) of crack length.
 - 2. Structural: Door corner structural strength test using a dual moment loading criteria as follows:
 - a. A representative corner section consisting of a 12 inch top rail and a 24 inch long stile.
 - b. Top rail of each section is anchored to a fixed surface at 3 inches from corner joint; a load arm was subsequently mounted at 19 inches from inside edge of top rail on suspended side rail.
 - c. A load was applied to the load arm at 19 inches from inside edge of side rail and amount of rotation of load arm observed. Process was repeated at increasing loads until point of failure defined as greater than 45 degrees rotation of load arm occurred.
 - d. Test results shall be supported by an independent laboratory test report, as follows:

- i. YKK AP Model: 50D Swing Door; 300 lbs.
- 3. Structural Uniform Load Test:
 - a. Single Doors: 90 psf.
 - b. Pair of Doors: 90 psf.
- 4. Forced Entry Resistance: 300 lbs. satisfactory.

1.03 PROJECT CONDITIONS / SITE CONDITIONS

- A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication: show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

1.04 SUBMITTALS

- A. General: Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Sections. Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract."
- B. Product Data: Submit product data for each entrance series specified
- C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, and finish colors.
- D. Samples: Submit verification samples for colors. Minimum 2-1/2 inch by 3 inch (61 mm by 73 mm) samples on actual aluminum substrates indicating full color range expected in installed system.
- E. Quality Assurance / Control Submittals:
 - 1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
 - 2. Installer Qualification Data: Submit installer qualification data.
- F. Closeout Submittals:
 - 1. Warranty: Submit executed warranty documents specified herein, endorsed by YKK AP authorized official and installer.
 - 2. Project Record Documents: Submit project record documents, including operation and maintenance data for installed materials in accordance with Division 1 Project Closeout (Project Record Documents) Section.
 - a. Maintenance Data: Maintenance procedures for care and cleaning of entrance systems.

PART 2: PRODUCTS

2.01 MANUFACTURERS (Acceptable Manufacturers/Products)

- A. Entrance Door Acceptable Manufacturers:

1. YKK AP America Inc., Austell, GA 30168, Telephone: (678) 838-6000
 2. Vistawall 500 Series
 3. Tubelite Standard Wide Stile Entrances
- B. Aluminum Screen Doors: Series 400SE Heavy-Duty Screen Door by Cline Aluminum Doors, Inc.
- C. Aluminum Storefront Entrance Door Products:
1. Wide Stile Swing Doors: YKK AP Series 50D Wide Stile Swing Doors with 6" mid-rail.
 - a. Description: 5" Door Stile
 2. Corner Construction: Fabricate door corners joined by concealed reinforcement secured with screws, and sigma deep penetration welding.
 3. Glazing Stops: Manufacturer's standard snap-in glazing stops with EPDM glazing gaskets to prevent water infiltration.
 4. Weather stripping: Manufacturer's standard pile type in replaceable rabbets for stiles; manufacturer's standard EPDM bulb type in doorframes.
- D. Hardware: ADA Compliant:
- a. Aluminum Threshold: Pemko 2005AV, or equivalent by National Guard or Hagar.
 - b. Weather stripping – perimeter wool pile: National Guard, Pemko, or Hager.
 - c. Continuous door sweep with drip – Pemko 345-V, or equivalent.
 - d. Push/Pull unless exit device indicated on door schedule.
 - e. Closer: LCN 4040XP, with backstop arm and hold-open feature, with prefinished metal cover.
 - f. Heavy-duty continuous Hinge: Pemko, McKinney, or Select Products.
 - g. Removable mullion at pairs of doors: Von Duprin; keyed operation.

2.02 MATERIALS

- A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.
- B. Aluminum Sheet:
1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050 inch (1.27 mm) minimum thickness.
 2. Painted Finish: ASTM B 209 (ASTM B 209M), 3003-H14 Aluminum Alloy, 0.080 inch (1.95) mm) minimum thickness.

2.03 ACCESSORIES

A. Manufacturer's Standard Accessories:

1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners, countersunk, finish to match aluminum color.
2. Sealant: Non-skinning type, AAMA 803.3.
3. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; Glazing gaskets in accordance with ASTM C 864.

2.04 RELATED MATERIALS (Specified In Other Sections)

- A. Glass: Refer to Division 8 Glass and Glazing Section for glass materials.

2.05 FABRICATION

- A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with uniform hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.

1. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer's recommendations.
2. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

B. Fabrication Tolerances:

1. Material Cuts: Square to 1/32 inch (0.8 mm) off square, maximum, over largest dimension; proportionate amount of 1/32 inch (0.8 mm) on other two dimensions.
2. Maximum Offset: 1/64 inch (0.4 mm) in alignment between two consecutive members in line, end to end.
3. Maximum Offset: 1/64 inch (0.4 mm) between framing members at glazing pocket corners.
4. Joints (Between adjacent members in same assembly): Hairline and square to adjacent member.
5. Variation (In squaring diagonals for doors and fabricated assemblies): 1/16 inch (1.6 mm).
6. Flatness (For doors and fabricated assemblies): +/- 1/16 inch (1.6 mm) off neutral plane.

2.06 FINISHES AND COLORS

- A. Anodized Finish: YKK AP AMERICA Anodized Finish

1. Clear: YKK AP YS1N with clear protective composite coating.

- B. Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:

1. Anodized Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612-02. Aluminum extrusions shall be produced from quality-controlled billets meeting AA-6063-T5.
 - a. Exposed surfaces shall be free of scratches and other serious blemishes.
 - b. Extrusion shall be given a caustic etch followed by an anodic oxide treatment and sealed with an organic electrodeposition applied protective top coating.
 - c. The anodized coating shall comply with all the requirements of AAMA 612-02; Voluntary Specifications, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction suites, and to resist the loss of color and gloss.
 - d. Overall coating thickness for finishes shall be a minimum of 0.7 mils.

C. Finishes Testing:

1. Apply 0.5% solution NaOH, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOH; Do not clean area further.
2. Submit samples with test area noted on each sample.

D. Anodized Finish Warranty: 10-year warranty commencing on Date of Substantial Completion.

PART 3: EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions.

3.02 EXAMINATION

- A. Site Verification of Conditions: Verify conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.
 1. Verify location of preset anchors, perimeter fasteners, and block-outs are in accordance with shop drawings.

3.03 PREPARATION

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.
 1. Aluminum Surface Protection: Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

3.04 INSTALLATION

- A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.

1. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or bituminous coating.
2. Shim and brace aluminum system before anchoring to structure.

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

3.06 ADJUSTING AND CLEANING

- A. Adjusting: Adjust swing doors for operation in accordance with manufacturer's recommendations.
- B. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to owner's acceptance, and remove construction debris from project site. Legally dispose of debris.
- C. Protection: The General Contractor shall protect the installed product's finish surfaces from damage during construction.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

1.01 SUMMARY

A. Section Includes: Aluminum Storefront Systems

1. YKK AP Series YES 45F-T MegaTherm™ Storefront System 2" x 4 ½".

B. Related Sections:

1. Sealants: Refer to Division 7 Joint Treatment Section for sealant requirements.
1. FRP Doors and Frames Section 08210
2. Glass and Glazing: Refer to Division 8 Glass and Glazing Section for glass and glazing requirements.

1.02 SYSTEM DESCRIPTION

A. Completed assemblies shall comply with all current NC Building code requirements.

B. Performance Requirements: Provide aluminum storefront systems that comply with performance requirements indicated, as demonstrated by testing manufacturer's assemblies in accordance with test method indicated.

1. Wind Loads: Completed storefront system shall withstand wind pressure loads normal to wall plane indicated:
 - a. Exterior Walls:
 1. Positive Pressure:
 2. Negative Pressure:
 - b. Interior Walls (Pressure Acting in Either Direction):
2. Deflection: Maximum allowable deflection in any member when tested in accordance with ASTM E 330-84 with allowable stress in accordance with AA Specifications for Aluminum Structures.
 - a. Without Horizontals: L/175 or 3/4" (19.1mm) maximum.
 - b. With Horizontals: L/175 or L/240 + 1/4" (6.4mm) for spans greater than 13'-6" (4.1m) but less than 40'-0" (12.2m).
3. Thermal Movement: Provide for thermal movement caused by 180 degrees F. (82.2 degrees C.) surface temperature, without causing buckling stresses on glass, joint seal failure, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or detrimental effects.

4. Air Infiltration: Completed storefront systems shall have 0.00 CFM/FT² (0.00 m³/h·m²) maximum allowable infiltration when tested in accordance with ASTM E 283-84 at differential static pressure of 6.24 PSF (299 Pa).
5. Water Infiltration: No uncontrolled water on indoor face of any component when tested in accordance with ASTM E 331-86 at a static pressure of 15 PSF (718 Pa).
6. Watertight Installations: Field Tested in accordance with AAMA 501.2-03.
7. Thermal Performance: When tested in accordance with AAMA 1503.1-88 Condensation Resistance Factor (CRF), and ASTM C 236-89 Thermal Transmittance (U Value) as follows:
 - a. CRF: A minimum of 59.
 - b. U Value: 0.58 BTU/HR/FT²/°F or less.

1.03 SUBMITTALS

- A. General: Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Sections. Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract."
- B. Product Data: Submit product data for each type storefront series specified.
- C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors and textures.
- D. Samples: Submit verification samples for colors on actual aluminum substrates indicating full color range expected in installed system.
 1. Typical framing member, with reinforcing
 2. Bent plate aluminum sill pan
- E. Quality Assurance / Control Submittals:
 1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
 2. Installer Qualification Data: Submit installer qualification data.
- F. Closeout Submittals:
 1. Warranty: Submit warranty documents specified herein.
 2. Project Record Documents: Submit project record documents for installed materials in accordance with Division 1 Project Closeout (Project Record Documents) Section.

1.04 QUALITY ASSURANCE

- A. Qualifications:
 1. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that

required for this project. If requested by Owner, submit reference list of completed projects.

2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving application method.
- B. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.
- C. Mock-Ups (Field Constructed): Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, and workmanship standard.
- D. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legal dispose of mock-up when no longer required.
- E. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.
- F. Field Test: Conduct field test to determine water-tightness of storefront system. Conduct test in accordance with AAMA 501.2-03 at locations selected by Architect.

1.05 PROJECT CONDITIONS / SITE CONDITIONS

- A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

1.06 WARRANTY

- A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under the Contract Documents.
 1. Beneficiary: Issue warranty in the legal name of the project Owner.
 2. Warranty Period: 5 years commencing on Date of Substantial Completion
 3. Warranty Acceptance: Owner is sole authority who will determine acceptability of manufacturer's warranty documents.
 4. Anodized Finish Warranty: 10-year warranty commencing on Date of Substantial Completion.

PART: 2 PRODUCTS

2.01 MANUFACTURERS (Acceptable Manufacturers/Products)

- A. Acceptable Manufacturers:

YKK AP America Inc., Austell, GA 30168, Telephone: (678) 838-6000

1. Storefront System: YKK AP YES 45F-T MegaTherm™ Storefront System.

Vistawall Series 3000-S
US Aluminum Series IT 451

B. Storefront Framing System:

1. Description: Center set, exterior flush glazed; jambs and vertical mullions continuous; head, sill, intermediate horizontal attached by screw spline joinery.
2. Components: Manufacturer's standard extruded aluminum mullions, 0-15 degree hinged mullions, 90 degree corner posts, flexible corner posts, three-way corner posts, entrance door framing, and indicated shapes.
3. Thermal Barrier: Provide continuous thermal barrier by means of 6/6 nylon polyamide glass fiber reinforced pressure extruded bars. Systems employing non-structural thermal barriers are not acceptable.
4. Provide .125" thick aluminum bent plate sill pan with end dams at exterior storefront systems. Profiles, sizes and shape as indicated on Drawings.
5. Doorstops to be integral fin type, snap-in type not acceptable.
6. Provide internal frame reinforcements all closer locations.
7. Provide 1/8" internal frame reinforcements at all FRP door entrance insert framing.
8. Provide steel internal frame reinforcements at all framing, sized as required to meet wind loading conditions.

2.02 MATERIALS

A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.

B. Aluminum Sheet:

1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050 inch (1.27 mm) minimum thickness.
2. Painted Finish: ASTM B 209 (ASTM B 209M), 3003-H14 Aluminum Alloy, 0.080 inch (1.95 mm) minimum thickness.

2.03 ACCESSORIES

A. Manufacturer's Standard Accessories:

1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners, countersunk, finish to match aluminum color.
2. Sealant: Non-skinning type, AAMA 803.3

3. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; Glazing gaskets in accordance with ASTM C 864.

2.04 RELATED MATERIALS (Specified In Other Sections)

- A. Glass: Refer to Division 8 Glass and Glazing Section for glass materials.
- B. Metal Window Panels: Refer to Division 8 Glass and Glazing Section for metal panel materials.

2.05 FABRICATION

- A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.
- B. Fabrication Tolerance:
 1. Material Cuts: Square to 1/32 inch (0.8 mm) off square, over largest dimension; proportionate amount of 1/32 inch (0.8 mm) on the two dimensions.
 2. Maximum Offset: 1/64 inch (0.4 mm) in alignment between two consecutive members in line, end to end.
 3. Maximum Offset: 1/64 inch (0.4 mm) between framing members at glazing pocket corners.
 4. Joints (Between adjacent members in same assembly): Hairline and square to adjacent member.
 5. Variation (In squaring diagonals for doors and fabricated assemblies): 1/16 inch (1.6 mm).
 6. Flatness (For doors and fabricated assemblies): +/- 1/16 inch (1.8 mm) off neutral plane.

2.06 FINISHES AND COLORS

- A. Anodized Finish: YKK AP AMERICA Anodized Finish
 1. Clear anodized finish, with clear protective composite coating.
- B. Finishing: Prepare aluminum surfaces for specified finish; apply finish in accordance with the following:
 1. Anodized Coating: Electrolytic color coating followed by an organic top coating applied to aluminum extrusions produced from quality-controlled billets meeting AA-6063-T5.
 - a. Exposed surfaces shall be free of scratches and other serious blemishes.
 - b. Extrusion shall be given a caustic etch followed by an anodic oxide treatment and sealed with an organic electrodeposition applied protective top coating.
 - c. Overall coating thickness for finishes shall be a minimum of 0.7 mils.

- d. Coating shall conform to Aluminum Association Standard AAM12C22A4X. A4X designation shall signify an anodic coating of 0.4 mils minimum followed by an organic top coating of a minimum 0.3 mils.
 - e. In addition to the Aluminum Association Standard above, finish shall conform to the following:
 - i. AAMA 605.2 Mortar Resistance Test Specification; Test Method per ASTM C207, 24 Hour Pat Test.
 - ii. CASS Corrosion Resistance Test. CASS 240/ASTM B368 Test Method.
 - iii. Other AAMA 605.2 Performance Tests specified in these specifications, such as: 7.3 Dry Film; 7.8.2 Salt Spray Resistance; 7.9.1.2 Color Retention, South Florida; 7.9.1.4 Gloss Retention, South Florida.
- C. Finishes Testing:
- 1. Apply 0.5% solution NaOH, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOH; Do not clean area further.
 - 2. Submit samples with test area noted on each sample.
- D. Anodized Finish Warranty: 10-year warranty commencing on Date of Substantial Completion.

PART 3: EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions.

3.02 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

3.03 PREPARATION

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

3.04 INSTALLATION

- A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.
 - 1. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or bituminous coating.
 - 2. Shim and brace aluminum system before anchoring to structure.
 - 3. Walls of storefront framing shall incorporate necessary steel reinforcing.

4. Provide .125" bent plate aluminum sill pans with end dams at exterior storefront systems. Provide profiles, sizes and shape as indicated on Drawings. Extend sill pans continuous with spliced joints; set in continuous beds of waterproofing sealant.
5. Verify storefront system allows water entering system to be collected in gutters and weeped to exterior. Verify weep holes are open, and metal joints are sealed in accordance with manufacturer's installation instructions.
6. Seal metal-to-metal storefront system joints using sealant recommended by system manufacturer.
7. All installation hardware and accessories required for a secure installation into rough openings, including shims, plates and anchors as necessary.

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.
- B. Field Test: Conduct field test to determine water-tightness of curtain wall system. Conduct test in accordance with AAMA 501.2-03 at locations selected by Architect.
- C. Perform minimum of three tests on various areas as determined by the Architect's representative. Perform test in Architect's presence. Field test first panels completed, then test all panels thereafter upon completion of all fixed panels. Generate and issue test report in compliance with AAMA 501.2-03 requirements.

3.06 ADJUSTING AND CLEANING

- A. Adjusting: Adjust operating items as recommended by manufacturer.
- B. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance, and remove construction debris from project site. Legally dispose of debris.
- C. Protection: The General Contractor shall protect installed product's finish surfaces from damage during construction.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

Part 1: General

Provide materials, labor, and equipment necessary to furnish and install architectural aluminum windows in accordance with the contract documents and detail drawings. Included but not limited to shall be:

1.01 Summary

A. Section includes

1. Aluminum sliding windows.
2. Aluminum single hung windows.
3. Glass and glazing.
4. Perimeter trims.
5. Sills, bent plate aluminum sill pans.
6. All installation hardware and accessories required for a secure installation.
7. Shims, plates and anchors required for a secure installation.
8. Perimeter sealing.
9. Insect screens

B. Related Sections

1. Section 08800 Glass and Glazing.
2. Section 07900 Sealants.
3. Section 08410 Entrance and Entrance Framing.

1.02 References

- A. American Architectural Manufacturers Association (AAMA)
- B. American Society for Testing Materials (ASTM)
- C. The Aluminum Association (AA)

1.03 System Description

- A. Completed assemblies shall comply with all current NC Building code requirements.
- B. The windows shall be Architectural Aluminum Windows in accordance with ANSI/AAMA 101-93 Voluntary Specifications for Aluminum and Poly Prime Windows and Glass Doors and AAMA 910-93, Voluntary "Life Cycle" Specifications and Test Methods for architectural grade windows and sliding glass doors for HC40 rated windows.
- B. Test Units.
 1. All test unit sizes and configurations shall conform to the minimum size in accordance with ANSI-AAMA 101-93 and AAMA 910-93.
 2. Units submitted for laboratory testing shall be units of the manufacturers standard construction, glazed and assembled in accordance with the manufactures specifications and ANSI/AAMA 101-93.
- C. Performance Requirements

1. Air Infiltration: The test specimen shall be tested in accordance with ASTM E283. The air infiltration rate shall not exceed .25 cfm/ft at a static air pressure differential of 6.24 psf.
2. Water Resistance: The test specimen shall be tested in accordance with ASTM E331. There shall be no leakage as defined in the test method at a static air pressure differential of 15.0 psf.
3. Uniform Load Deflection: A minimum static air pressure difference of 40 psf shall be applied in the positive and negative direction in accordance with ASTM E330. There shall be no deflection in excess of 1/175 of the span of any framing member.
4. Uniform Load Structural Test: A minimum static air pressure difference of 85.5 psf shall be applied in the positive and negative direction in accordance with ASTM E330. The unit shall be evaluated after each load.
5. Component Testing: Window components shall be tested in accordance with procedures described in ANSI/AAMA 101-93.
6. Condensation Resistance Test: (CRF) windows shall be tested in accordance with AAMA 1503.1-88.
7. Thermal Transmittance Test: (Conductive U-Value) windows shall be tested in accordance with AAMA 1503.1-88.
8. Life cycle testing for architectural grade windows when tested in accordance with AAMA 910-93, there shall be no damage to fasteners, hardware parts, support arms, actuating mechanisms or any other damage which would cause the window to be inoperable, and air infiltration and water resistance tests shall not exceed the primary performance specified herein.
9. Forced entry resistance: All windows shall conform to ASTM F588-85 (Performance Level 10) or AAMA 1303.5-1976 to govern.
10. Thermal Barrier Test Procedure.
 - a. Place a 35-1/4" length of the composite section in an oven at 106°F for a minimum of one (1) hour.
 - b. Remove the composite section from the oven and place in a freezer at 0°F for a minimum of one (1) hour.
 - c. Repeat this process for an additional 90 cycles.
 - d. Inspect for shrink-back of the polyurethane material.
 - e. Test for loss of stiffness by loading as a beam to produce a deflection of the composite member. This load shall be sufficient as to produce a stress in the aluminum equal to 100% of the allowable extreme fiber bonding stress.
 - f. Testing shall be in accordance with AAMA TIR- A8-1990 "Structural Performance Pour and Debridged Framing System."

1.05 Submittals

DIVISION 8
WINDOWS
SECTION 08500
WINDOWS

DOORS AND
ALUMINUM

- A. General: Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract". Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract".
 - B. Product Data: Submit product data for each type of product specified.
 - C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish and colors. Drawings shall include accurate representation of rough opening section details showing complete anchorage, sealing and weeps.
 - D. Samples: Submit verification samples for window type and finish.
 - E. Samples: Submit verification samples for bent plate aluminum sill pan.
- E. Quality/Control Submittals.
- 1. Design data: All windows shall meet or exceed ANSI/AAMA 101-93 and AAMA 910-93 for AW-65 rated windows.
 - 2. Test reports: Submit certified test reports, showing compliance with specified performance characteristics and physical properties.
 - 3. Certificates: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical requirements.
 - 4. Certification that designated window units meet requirements and clearances for Emergency Egress Windows.
 - 5. Manufacturer's installation instructions.
- 1.04 Quality Assurance
- A. Qualifications
 - 1. Installer qualifications: The installer shall be a company specializing in the installation of aluminum windows with a minimum of three (3) years of experience.
 - 2. Manufacturers qualifications: Manufacturer shall be capable of providing field service representation during construction, approving acceptable installer and approving application method.
 - 3. The window manufacturer shall be engaged in a TQM Continuous Quality Improvement Program for a period of not less than five (5) years.
 - 4. To assure the performance specified. The window manufacturer shall test for air infiltration and water resistance at a minimum of two units, per manufacturing line, per shift in accordance with ANSI/AAMA 101-93.
 - B. Regulatory Requirements.

1. Published specifications, standards, tests, or recommended methods of trade, Industry, or governmental organizations apply to work in this section.

2. Meet all handicapped requirements.

1.07 Delivery, Storage, and Handling

- A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- B. Store and handle windows, mullions, trim and hardware in strict compliance with the manufacturer's instructions.
- C. Protect all window materials adequately against damage from the elements, construction activities and other hazards before, during and after installation.

1.08 Project Conditions/Site Conditions

- A. Field measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

1.11 Warranties

- A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under the Contract Documents.
 1. Beneficiary: Issue warranty in the legal name of the project owner.
 2. Warranty Period:
 - a. Windows shall be two (2) years commencing on date of shipment.
 - b. Insulating glass shall be warranted to be free from defects (excluding breakage) for a period of five (5) years commencing on date of shipment.
 - c. The installation shall be warranted against defects for one (1) year from date of installation. (supplied by installer)

Part 2: Products

2.01 Manufacturers

- A. Acceptable Window Manufacturers
 1. Architectural sliding aluminum windows shall be EFCO Series 6555 HS sliding window as manufactured by the EFCO Corporation, or YKK AP Series - YSW 400 T HS sliding window as manufactured by the YKK Company, or equivalent by Traco or Kawneer.

2. Architectural single hung aluminum windows shall be EFCO Series 660 single hung, AW-PG60-H rated, as manufactured by the EFCO Corporation, or YKK AP Series - YVS 410 TU, AW-65 rated, as manufactured by the YKK Company, or equivalent by Traco or Kawneer.
3. Minimum AAMA Designation: AW-65 or greater to meet specifications.
4. Sash vent size for designated egress openings to conform to egress window requirements per the North Carolina Building Code.
5. Sliding Mall Front Model MS-360, using a multiple track assembly, by Vistawall Architectural Products. Aluminum sliding mall front system, complete with reinforcing, fasteners, anchors, attachment devices, and door hardware. Aluminum door leafs within system.

- B. Manufactured products specified shall be considered as the standard for materials, sizes, finish, and quality.

2.03 Materials

A. Aluminum for Windows and Components.

1. Extruded aluminum profiles shall be 6063-T5 alloy and temper (ASTM B221M).
2. The frame and vent depth shall be not less than 3 7/8". Horizontal frame members run through notched vertical members, butted and mechanically fastened with (2) stainless steel screw anchors per joint.
3. All extrusions for frame jamb and horizontal members, sash and vent members shall have minimum wall thickness of .062" and shall provide the structural strength sufficient to meet the specified performance requirements. Frame sill members shall have minimum wall thickness of .094".
4. All references to dimensions for wall thicknesses and other cross-sectional dimensions of window members are nominal and in compliance with ANSI H35.2-1990.
5. All glass pockets shall be weeped to provide positive drainage. Water shall be weeped to the exterior via frame weep slots protected by a hooded cover or integral drips.

B. Thermal Barrier.

1. The thermal barrier shall be 0.49 BTU/HR/OFT/F2 when tested in accordance with with ASTM C236.
2. The thermal barrier shall consist of a two-part chemically curing, high density polyurethane.
3. The thermal cavity shall be mechanically joined to the aluminum in such a way that the the average shrink-back of the polyurethane will not exceed 1% of the total length of the composite section and shall maintain its composite strength when subjected to the thermal cycling.

C. Insect Screens: Provide insect screens where indicated on Drawings.

2.06 Components

A. Fasteners

1. Fasteners, where exposed, shall be 300 series stainless steel.
2. Perimeter anchors shall be aluminum or steel, providing the steel is properly separated from the aluminum.

B. Glazing Materials.

1. Glazing materials shall be compatible with aluminum and those sealants and sealing materials used in composite structure which have direct contact with the gasket.
2. Standard exterior and interior glazing gaskets shall be a dry glazed elastomer in accordance with ASTM C509-91.
3. Interior air sealants shall be silicone and shall meet AAMA 802.5-92 (Type II).
4. Glazing beads shall be extruded aluminum and shall be a minimum thickness of .050 inches.
5. Frames shall be weatherstripped with a resilient foam core clad with UV-resistant elastomer.

C. Glass and Glazing.

1. Glass shall be 1" sealed Low-E insulating glass, "Neutral Tint"; refer to Division 8 Glass and Glazing Section for glass materials. Safety glass shall meet ANSI Z-97. Tempered glass shall meet ASTM C 1048.

D. Hardware.

1. Locking hardware, cams, strikes, keepers and pole rings shall be cast white bronze. All hardware fasteners penetrating the frame or inside plane of the window shall be factory sealed with resilient non-hardening sealant.
2. Locking arrangement at meeting rail shall be a device that provides for positive locking. All latching arrangements at the meeting rail shall be easily replaced and repaired without disassembly of sash members. Any window over 40 inches in height shall come standard with two locking devices at the meeting rail. All windows shall meet AAMA Specification 1302 and ASTM Specification F588 for forced entry requirements. Locking arrangement on the meeting rails shall be of the cam action type pulling sash together and made of high pressure zinc die cast, baked enamel painted finish.
3. Hardware for Sliding Assemblies:
 - a. Manufacturer's heavy-duty wheel track design, complete with appropriate support assemblies. Bottom rail casters and top rail guides. Cylinder operated flushbolts with bottom bolt extension. Equip with provisions for cylinder on interior side only, with backset 31/32 inches. One unit required at assemblies sliding in single direction. Locate in terminating jamb. Cylinders as specified in Section 08710. Limit stops/bumpers: Manufacturer's standard resilient type. Finish: clear anodized.

2.09 Fabrication

A. Construction.

1. Frame.

- a. All main framing corners shall be coped and butt-type construction, neatly joined and mechanically secured by means of two (2) screws per joint anchored into integral screw races.
- b. All framing joints shall be sealed with quality grade sealant meeting AAMA 803.3 to ensure a water tight joint.

2. Exterior Panning and Trims.

- a. Shall be extruded aluminum of 6063-T5 alloy and temper of the profile and dimensions as detailed on the approved drawings. All joints shall be sealed with quality grade sealant to ensure water tight joints.

3. Aluminum Sill Pans

- a. Shall be minimum .125" aluminum bent plate of 6063-T5 alloy and temper, anodized finish matching window framing. Profile and dimensions as detailed on the Drawings. Sill pan shall feature integrally formed end dams at wall opening jambs. All joints shall be sealed with quality grade sealant to ensure watertight joints.

4. Mullions.

- a. Mullions and cover plates shall be of extruded aluminum of 6063-T5 alloy and temper of the dimension and profiles shown on the approved drawings.
- b. Mullions must provide adequate structural properties to resist wind pressure as specified herein.

5. Anchoring:

- a. Flat sheets of aluminum of 6063-T5 alloy shall be utilized for heads and jambs anchoring frames to back-up walls as necessary.

2.10 Finishes

A. A. Anodized Finish: YKK AP AMERICA Anodized Finish:

- 1. Clear anodized, with protective composite coating.

E. Finish: Prepare aluminum surfaces for specified finish; apply finish in accordance with following:

- 1. Anodized Coating: Electrolytic color coating followed by an organic top coating applied to aluminum extrusions produced from quality-controlled billets meeting

AA-6063-T5.

- a. Exposed surfaces shall be free of scratches and other serious blemishes.
- b. Extrusion shall be given a caustic each followed by an anodic oxide treatment and sealed with an organic electrode position applied protective top coating.
- c. Overall coating thickness for finishes shall be a minimum of 0.7 mils.
- d. Coating shall conform to Aluminum Association Standard AAM12C22A4X, A4X designed shall signify an anodic coating of 0.4 mils minimum followed by an organic top coating of a minimum 0.3 mils.
- d. In addition to the Aluminum Association Standard above, finish shall conform to the following:
 - i. AAMA 605.2 Mortar Resistance Test Specification; Test Method per ASTM C207, 24 Hour Pat Test.
 - ii. CASS Corrosion Resistance Test. CASS 240/ASTM B368 Test Method.
 - iii. Other AAMA 605.2 Performance Tests specified in these specifications, such as 7.3 Dry Film; 7.8.2 Salt Spray Resistance; 7.9.1.2 Color Retention, South Florida; 7.9.1.4 Gloss Retention, South Florida

C. Finishes Testing:

- 1. Apply 0.5% solution NaOH, sodium hydroxide, to small area of finished sample area, leave in place for sixty minutes; lightly wipe off NaOH; Do not clean area further.
- 2. Submit samples and test area noted on each sample.

Part 3 Execution

3.01 Acceptable Installers

- A. Comply with manufacturer's product data, including product technical bulletins, product catalog and installation instructions.

3.02 Examination

- A. Site Verification of Conditions: Verify that substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's installation instructions.

3.03 Preparation

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

3.04 Installation.

- A. Windows shall be installed by skilled craftsman in accordance with the manufacturer's recommendations, approved shop drawings, installation instructions, and contract documents.

- B. Frames shall be supported level, square, plumb, and in alignment without twist or bow, and accurately fitted with tight joints and intersections. Provide all necessary anchors and/or plates or extensions for frame anchorage to rough openings, for complete assemblies.
- C. All joints between framing and the building structure shall be sealed in order to secure a watertight installation.
- D. Provide .125" aluminum bent plate sill pans at exterior window systems. Provide profiles, sizes and shape as indicated on Drawings. Extend bent plate sill pans continuous with spliced joints; set in continuous beds of waterproofing sealant. Form integral end dams at wall opening jambs.

3.08 Adjusting and Cleaning

- A. Adjusting: Frame and operating hardware shall be adjusted after installation to insure smooth and watertight operation.
- B. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.
- C. Protection: After installation, the contractor shall adequately protect exposed portions of aluminum surfaces from damage by grinding and polishing compounds, plaster, lime, acid, cement or other contaminants. Any aluminum member which has damaged surface shall be removed and replaced at no extra cost to the owner.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall include all labor, materials, equipment, transportation, tools and storage required for complete installation of all finish hardware shown and scheduled on Drawings and specified herein. Intent of this Specification is to provide complete finishing hardware requirements for entire building project excepting hardware, which is specifically mentioned hereinafter as being furnished by others. Any openings not specifically mentioned herein shall be furnished consistent with hardware specified for similar openings.

Wood doors for Project are pre-fit. Coordinate with wood door manufacturer in furnishing hardware templates and schedules at earliest possible time.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers: Hardware listed in Hardware Schedule shall be supplied by one of following Manufacturers listed for each item or an equal. To establish quality of hardware required, catalog numbers of Manufacturers listed in Hardware Schedule have been used. Hardware furnished shall be of equal type, design, quality and function as that specified in Hardware Schedule.

Acceptable Manufacturers: Similar items manufactured or furnished by other manufacturers may be submitted for approval, subject to these Specification requirements and written approval received 7 days prior to bid date.

Supplier's Qualifications: Contractor shall select only supplier who has in his employ qualified personnel, who shall manage and coordinate complete hardware contract, and shall also be available to visit Project in order to solve or correct conditions affecting proper hardware installation or adjustment, as required.

SUBMITTALS:

Schedule: Submit Hardware Schedule to Architect in six (6) copies, as promptly as possible, showing quantities, types, catalog numbers and locations of various items of finish hardware required. Submit as specified for shop drawings in accordance with GENERAL CONDITIONS.

Job Completion Instructions: At completion of work turn over to Owner all tools, instructions, and maintenance information for his use in maintaining hardware. Furnish Owner also with two copies of Job Use Finish Hardware Schedule, Key Schedule and Master Bitting List for his permanent records.

PRODUCT HANDLING:

Packing, Marking and Labeling: Deliver hardware to project site in manufacturer's original packages. Each article of hardware shall be neatly wrapped and individually packed in substantial carton or other container, properly marked or labeled to be readily identifiable with Hardware Schedule.

Storage: General Contractor shall furnish secure storage area for delivery by Hardware Supplier of finish hardware and storage of same. General Contractor shall be responsible for shortages due to theft and pilferage.

General Contractor shall provide in storage area adequate counters, shelves, and bins for assembly and grouping of hardware for distribution and installation.

PART 2: PRODUCTS

TYPES, SIZES AND DESCRIPTIONS:

Hardware shall be of types and sizes listed in this Section, applied with fastenings of proper size, quantity and finish.

Templates: Hardware for application on metal shall be made to standard templates. Furnish physical samples or templates, as required to Manufacturer of metal doors and frames for proper manufacturer and application.

Reinforcement: Reinforcing for hardware shall be furnished and installed by Door and Frame Manufacturer.

Modifications to hardware required by reasons of construction characteristics shall be such as to provide same operative or functional features. Modifications to hardware shall be made only with Architect's approval, after consultation with the Owner.

Provide hardware for fire rated openings in compliance with UL, UL 10C-1998, UBC 7-2-1997, NFPA-80 and CFR Part 36 (ADA) guidelines. Provide only hardware, which has been tested and listed by UL for types and sizes of doors scheduled. All hardware shall conform to ADA requirements. These requirements take precedence over any other requirements or specifications of this section.

Category "A" Positive Pressure Installations:

Hardware located above 40" AFF to be listed and labeled in accordance with UBC 7-2-1997 and UL 10C-1998 for use in positive pressure fire rated wood doors.

In order to meet smoke requirements, a smoke seal, listed and labeled for UBC 7-2-1997 Parts 1 and 2 positive pressure installations, must be mounted around the perimeter of the doorframe.

Flat bar type astragals only will be allowed on pairs of doors with fire ratings up to 60 minutes with concealed intumescent inside the door structure.

Door Smoke Seals: Doors in smoke partitions shall meet the requirements for a smoke and draft control assembly tested in accordance with UL 1784 for Smoke, and installed in accordance to NFPA 105-2010 Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives.

Provide strikes with extended lips as necessary.

Provide strike boxes, with dust box inserts.

Provide doors to loading platforms, boiler and mechanical rooms, stages or platforms, utility stairs, and electrical closets with knurling on inside of lever.

KEYING REQUIREMENTS

All interior and exterior keyed locking devices are to be furnished with Schlage interchangeable core cylinders.

Furnish all exterior keyed devices with temporary construction cores.

All interior keyed locking devices to be construction master keyed, and grand master keyed to a Schlage Everest 134 D great grand master key system and keyway as designated by Owner.

Provide 6 keys per cylinder, stamped with keying symbol, to the Owner.

Provide a keying transcript and master bitting list for the project directly to the Owner via e-mail and hard copies via transit.

All permanent keys, permanent control keys, and permanent cores are shipped directly to the hardware supplier from Schlage, whereupon all materials shall be inventoried and checked for compliance. Upon completion of inventory and compliance check, the hardware supplier will deliver all permanent keys and permanent cores directly to the Owner. The Owner shall retain possession until the proper time for the hardware supplier to install into exterior keyed devices and converting interior construction master keyed devices to the permanent keying system.

Provide 300 D 134 key blanks.

Provide a key schedule sorted by key symbol.

Provide a key schedule sorted by door number.

The general contractor shall be furnished 5 temporary construction keys and 2 temporary core control keys for the exterior keyed devices.

The general contractor shall be furnished 5 construction master keys for the interior keyed devices and 2 extractor devices used to disable the construction master key system. Note: All construction keys to be turned over to the Owner at same time permanent cores and permanent keying are installed.

Two (2) extractor devices shall be provided to the Owner.

The hardware supplier shall furnish the permanent cores to the Owner, after receipt from Schlage and completion of inventorying and the compliance check. At the proper time, the hardware supplier is to obtain the permanent cores from the Owner, install them in all exterior keyed devices, and disable the construction master key system for all interior keyed devices using the extractor tool to remove, insert, and turn all cylinders to assure each assigned key works properly.

The general contractor shall install the key cabinet. The hardware supplier shall set up the key cabinet with the Owner's representative and user present, prior to the completion of construction. The Owner shall be notified 3 weeks in advance.

Representatives from the General Contractor, manufacturer, and hardware supplier shall meet with the Architect's representative and Owner to receive keying instructions prior to preparing the keying schedule for approval.

The Owner shall be provided a minimum of one (1) key for each miscellaneous device; such as fire extinguisher cabinets, cabinet doors, water hose bibs, light switches, low voltage keyed electrical devices, etc. Where any contract requires a greater quantity, provide the more stringent option.

Owner's Representative: Brooks Moore, Ben Barbour

Keying is to be as follows:

- A. Keyway: Everest 134 D (unless otherwise noted)

- B. SKD-1 Principal's Office (6 keys)
SKD-2 Record's Room (6 keys)
SKD-3 Dry Storage in Kitchen (6 keys)
- C. Grand Masters: (Key that will open every door on campus except SKD doors. Configured to school system's master plan). (20 keys)
- D. Building Area Masters: (Master key for each separated building area – 100, 200, 300, 400, 500 (6 keys each).
- E. Sub Masters: (All suite-like areas are to have a master key to this area – Media, Admin, Band, Cafeteria, and others as specified by Architect). (6 keys each)
- F. Equipment Platforms and Mechanical Doors, including Boiler Room: Everest D 134 (25 keys).
- G. Keyed Removable Mullions: D 134 keyway
- H. Change Key: (individual door key for every door, 6 keys per cylinder) (not to exceed 6 keys per key set).

HARDWARE ITEMS:

Locksets: Schlage and Schlage L9000 Series mortise locksets. Provide Everest removable cores for all interior and exterior doors, including exterior doors with exit devices. All cylinders shall be "factory pinned" using original Schlage pins and Schlage brass key blanks. Provide sectional trim, wrought rose 93A.

Closers: LCN 4040XP Heavy-Duty, with pre-finished metal cover

Exit Device: Von Duprin 99 L (F as required), with cylinder and core.

Door Stops: All doors shall be provided with wall stops or overhead stops, to suit condition. For example, doors opening onto millwork or open space shall receive overhead stops. Solid wood blocking to be installed at all gypsum wallboard wall stop locations. Provide floor stops at fire doors with magnetic hold open devices.

Fire rated openings: All fire rated openings, except classrooms, shall receive closers and ball bearing hinges, whether scheduled or not.

Knox Box: (provided by GC) Where indicated, provide 3200 Series KNOX-BOX, surface/recessed mount with hinged door, with UL Listed tamper switches, 1/4" plate steel housing, 1/2" thick steel door with interior gasket seal and stainless steel door hinge. Box and lock UL Listed. Lock has 1/8" thick stainless steel dust cover with tamper seal mounting capability. Lock: UL Listed. Double-action rotating tumblers and hardened steel pins accessed by a biased cut key.

Coordinators: All door pairs with closers to be provided with coordinator devices as necessary for proper sequential closing operation.

Astragals: Non-fire rated door pair with flush bolts shall receive steel astragal on exterior side edge of the active leaf. Pairs of smoke or fire doors shall receive steel astragals, coordinators, and smoke seals and necessary hardware to meet fire rating designated.

Keyed Removable Mullions: All interior and exterior mullions to be removable with keyed operation, with cylinder and Everest 134 D cores installed by the general contractor and turned by the hardware supplier.

Hinges: HD Heavy-duty hinges shall be provided for all doors exceeding 36" width or 86" height. Provide fire-rated hinges on all fire rated doors. Provide electric hinges on doors scheduled for EAC (electronic access control) hardware. Exterior hinges shall be HD heavy-duty with non-removable pins. Hinges for doors with closers shall be ball bearing.

View Windows: Provide factory finished metal stops for view windows. Wherever doors are equipped with exit devices, view windows shall have concealed / flush glass beads.

Fasteners:

Use concealed fasteners whenever possible, except where noted specifically otherwise. Install door closers with (4) through-bolted oval head bolts.

Hardware to be installed on metal work shall be furnished with machine screws. For interior exposed fasteners on bronze or brass material, use matching color and material for fasteners. For all other exposed fasteners on interior, use stainless steel, except where noted specifically otherwise. Furnish stainless steel screws for all exterior work.

Install fixed locking screw in strike plate for exterior locksets after final adjustments made during 6-Month Service and Adjustment Inspection. Provide confirmation in written 6-Month Service and Adjustment Inspection report.

All Products shall be by the following manufacturers - no exceptions:

Hinges: Hager, HB Ives, McKinney

Electric Hinges: ETW electric through wire hinge, with four continuous electric conductors, full mortise ball bearing, with Molex type connectors, by Hager.

Locks: Schlage Extra Heavy-Duty Mortise L9000 Series

Electrified Mortise Lockset: Schlage L909x Series, complete assembly with power supply, and electric thru wire hinge EPT.

Exit Devices: Von Duprin

Exit Devices at Electronic Access Control doors (Furnished and installed by the General Contractor's Division 8 Subcontractor): Von Duprin QEL, with electric hinges for hinge edge power transfer.

Closers: LCN 4040XP Heavy-Duty, with pre-finished metal cover

Cylinders: Schlage Full Size Interchangeable Core, all interior and exterior cylinders to be provided with interchangeable cores

Knox Box: 3200 Series KNOX-BOX

Overhead Stops: Corbin, Checkmate, Glynn-Johnson

Flatgoods: Quality, Baldwin, HB Ives

Thresholds: National Guard, Pemko, Hager.

Push/Pulls: Rockwood Manufacturing, HB Ives, Hager.

Push/Pull Latches: Glynn-Johnson

Stops: Glynn-Johnson, Rockwood Manufacturing, HB Ives.

Flush Bolts: Glynn-Johnson, Rockwood Manufacturing, HB Ives, Hager.

Silencers: Glynn-Johnson, Rockwood Manufacturing, HB Ives.

Kick Plates: Rockwood Manufacturing, HB Ives, Hager.

Automatic Flush Bolts: HB Ives, Rockwood Manufacturing.

Coordinator: HB Ives, Rockwood Manufacturing, Trimco

Weather Strip & Rain Drips: National Guard, Pemko, Hager, Reese

Smoke Perimeter Door Frame Gaskets: Pemko, Hager, Reese

Smoke Door Bottom Sweep: Pemko, Hager, Reese

Door Bottoms: National Guard, Pemko, Hager.

Magnetic Door Holders: LCN SEM 7800 Series, with adjustable extension length.

Other items shall be as scheduled.

Materials and Finishes: (All products except closers, thresholds, weatherstripping to have brass or bronze base metal unless otherwise noted). Provide the following hardware material as scheduled in the door schedule:

	<u>Materials</u>	<u>Finishes</u>
Hinges, Outswing Exterior Doors	Stainless Steel	US 32 D
Hinges, Inswing Exterior Doors	Stainless Steel	US 32 D
Hinges, Interior Doors	Steel	US 26 D
Pivots	Satin Chrome Plate	US 26 D
Exit Devices	Satin Chrome Plate	US 26 D
Cylindrical Lock Trim	Satin Chrome Plate	US 26 D
Dead Lock Trim	Satin Chrome Plate	US 26 D
O.H. Holders & Stops	Satin Chrome Plate	US 26 D
Door Stop and Holders	Satin Chrome Plate	US 26 D
Box Strikes	Wrought	Prime
Thresholds	Aluminum	Aluminum
Thresholders	Steel	Galvanized Steel
Weatherstrip	Aluminum	Aluminum
Flatgoods	Stainless	US 32 D

Provide the following hardware material as scheduled in the door schedule:

Hinges with closer	BB 1279	4 ½ x 4 ½
St/Stl hinges with closer	BB 1191	4 ½ x 4 ½
HD hinges with closer	BB 1168	4 ½ x 4 ½
St/Stl HD hinges w closer	BB 1199	4 ½ x 4 ½
Hinges without closer	1279	4 ½ x 4 ½
St/Stl Hinges without closer	1191	4 ½ x 4 ½
Electric Hinges	ETW	4 ½ x 4 ½
Privacy set	L9040	93A
Staff Toilet Privacy set	L9040	93A
Passage set	L9010	93A
Classroom security lockset	L9071	93A
Entrance lockset	L9050	93A

Office lockset	L9050 93A
Storeroom lockset	L9080 93A
Push/Pull latchset	HL6
Electrified Mortise Lockset:	Schlage L909x Series
Electric Strike:	Von Duprin 6000 Series
Exit device	99 L (F as req'd) (provide NL- all exterior doors – provide 5 dogging keys per opening, delivered to Owner) Exterior pull right side on pairs of doors.
Exit Device at EAC	QEL with EPT where EAC (Electronic Access Control) is scheduled.
LBR Exit device (interior)	9927 LBR (surface mounted vertical rod, less bottom rod) interior doors scheduled (F as req'd)
Keyed Removable Mullion Cylinder	KR4954, KR9954 as required (all door pairs throughout)
Exterior Closer	4040XP – CUSH – HOLD OPEN – AL, non-handed, backstop where scheduled
Interior Closer	4040XP – EDA – AL, non-handed, backstop where scheduled
Kickplate	1935 8 x 2 LDW
Wall stop	232 W
Floor stop	241 F
Overhead stop	9-331
Flush bolts	282 D, with astragal and top and bottom plungers
Threshold	Pemko 2005AV
Upper rain drip	Reese R201C
Lower rain drip/sweep	Pemko 345_V
Frame Smoke gasketing	Pemko 332CR
Door Bottom Smoke Sweep	Pemko 307AV
Perimeter gasketing	Pemko 296_R
HD Interlock gasketing	Pemko 336
Push plate	70C 4 x 16
Pull handle	107 x 70C 4 x 16
Key cabinet	Expand existing key cabinet as required for additional keys.

General and Special Hardware Notes:

1. All doors to receive hinges as specified
2. All doors to receive wall or overhead stops to suit condition of use. Doors with magnetic hold opens to receive floor stops.
3. Provide closers with backstops for exterior doors and to suit condition of use.
4. All steel frames to be provided with silencers.
5. Exterior doors to be provided with weather-stripping and thresholds.
6. All exit devices to be provided with cylinders.
7. At pairs of doors, pull side, provide pull or lever right side only.
8. Provide cylinders for keyed mullions supplied by aluminum door supplier.
9. Exit devices at exterior doors to NL with pull, unless otherwise indicated.
10. Exit devices at interior doors to be classroom function with lever.

Pneumatic Automatic Door Openers:

Provide automatic, single leaf door opener, complete operational assembly, at main front entrance, and at locations indicated on Drawings. Motor and controller capacity to be sized for a single door operator, and shall meet all accessibility codes manual force requirements of 5 lbs. Full closing force shall be provided when the power or assist cycle ends.

All power operated systems shall include compatibility with key pads or card readers and have built-in supply for actuators and peripherals, power actuators, remote actuators, and be compatible with electric latch retraction, electric strikes or magnetic locks.

All units shall be covered by a 2-year warranty.

All units shall be inspected by the factory representative for proper installation and function after installation.

Interior and Exterior Wall Plate Actuators: Actuators shall be hardwired low voltage and shall have a stainless steel 4 ½" round plate with engraved blue filled accessibility symbol. At all locations the actuator box shall be built into the wall construction flush, providing a box made of industrial grade components, and providing weather resistant installation at exterior locations. When required, exterior actuator will be deactivated with adjacent key switch. LCN 956, LCN 958.

Automatic Door Opener:	LCN	4822 Reg, Auto-Equalizer, Pneumatic Operator
(hardwired)	LCN	4822-18G Drop Down Plate
	LCN	4822-3077L Long Arm (if required)
	Frame Manuf.	Set of Integral Seals
	LCN	Interior and Exterior 8310-856 Wired Actuator Pads
	LCN	868F and 868S Mounting Boxes (to suit condition)
	LCN	7982ES Controller
	LCN	925 1/8" ID Tubing
	Locknetics	(2) 653-1414-L2 Key Switch with (2) LED Lights
	Various	(2) Cylinders For (2) Key Switches
	SCE	Remote Release Actuator 701RD-AA
	Various	Wire Supplies, Conduits, Boxes and Misc. Materials for Complete Assembly

ELECTRONIC ACCESS CONTROL SYSTEM / ENTRY HARDWARE DEVICES

1. WHERE INDICATED ON DRAWINGS, PROVIDE ACCESS CONTROL SYSTEM DEVICES AND COMPONENTS LISTED, DOOR HARDWARE AND ACCESSORIES, FULLY COMPATIBLE WITH AN S2 SECURITY ACCESS CONTROL SYSTEM AND SOFTWARE PROGRAM, INCLUDING BUT NOT LIMITED TO THE FOLLOWING COMPONENTS. ALL HARDWARE / EQUIPMENT SPECS SHALL COMPLY WITH JOHNSTON COUNTY SCHOOL STANDARDS.
 - a. ACCESS CONTROL BASE STATION: COMPUTER SOFTWARE PROGRAM, INSTALLED ON OWNER'S PC, FOR SOFTWARE CONTROL OF CONNECTED DOORS - PROVIDED BY THE DIVISION 17 ACCESS CONTROL CONTRACTOR.
 - b. ACCESS CONTROL SYSTEM FIELD PANEL: S2 NETWORK NODE, S2-NN-E2R-WM, HOUSING UP TO SEVEN (7) S2 APPLICATION BLADES, SUPPORTING UP TO 14 DOORS, WITH NETWORK DROP - PROVIDED BY THE DIVISION 17 ACCESS CONTROL CONTRACTOR. ELECTRICAL CONTRACTOR TO PROVIDE ELECTRICAL POWER.
 - c. DOOR CONTACTS FOR NEW DOOR/FRAMES: RECESSED DOOR SWITCH SETS, GRI 180 SERIES, 195-12WG, BY GEORGE RISK INDUSTRIES. DOUBLE POLE, DOUBLE THROW, WIDE GAP. PROVIDED BY THE DIVISION 17 ACCESS CONTROL CONTRACTOR. ELECTRICAL CONTRACTOR TO PROVIDE RACEWAY TO DOOR FRAME.
 - d. CARD / PROXIMITY READER UNIT, MODEL S2 900PTNNEK00460-S2SEC, MINI-MULLION VERSION, ALL LOCATIONS WHERE EAC (ELECTRONIC ACCESS CONTROL) IS REQUIRED. PROVIDED BY THE DIVISION 17 ACCESS CONTROL SYSTEM CONTRACTOR.
 - e. FOR EAC DOORS INDICATED, VON DUPRIN QUIET ELECTRIC LATCH RETRACTION – QEL EXIT DEVICE 98/99 SERIES. PROVIDED AND INSTALLED BY DIVISION 8 DOOR HARDWARE SUPPLIER.

- F. ELECTRIC STRIKE (WHERE INDICATED): VON DUPRIN 6000 SERIES, WIRED TO CONTROL ACCESS SYSTEM AND REMOTE OPERATION LOCATION.
 - G. ELECTRIFIED MORTISE LOCKSET: SCHLAGE L909x SERIES. PROVIDED AND INSTALLED BY DIVISION 8 DOOR HARDWARE SUPPLIER.
 - H. ELECTRIC HINGES: FOR USE WITH QEL EXIT DEVICES AND ELECTRIFIED MORTISE LOCKSETS; HAGER ETW ELECTRIC THROUGH WIRE HINGE, WITH FOUR CONTINUOUS ELECTRIC CONDUCTORS, FULL MORTISE BALL BEARING, WITH MOLEX TYPE CONNECTORS, BY HAGER. PROVIDED AND INSTALLED BY DIVISION 8 DOOR HARDWARE SUPPLIER.
 - I. POWER SUPPLIES, FOR ALL POWERED DOOR LOCKING HARDWARE / EXIT DEVICES. PROVIDED AND INSTALLED BY DIVISION 8 DOOR HARDWARE SUPPLIER.
2. INTERCOM / VIDEO CAMERA UNIT (DOOR CALL STATION UNIT): PROVIDED BY THE DIVISION 17 ACCESS CONTROL SYSTEM CONTRACTOR. ELECTRICAL CONTRACTOR TO PROVIDE RACEWAYS AND ROUGH-IN BOXES.

WHERE INDICATED, PROVIDE A COMPLETE VIDEO INTERCOM BUZZ-IN ACCESS SYSTEM ASSEMBLY, AIPHONE JKS-1AEDV OR EQUIVALENT BY COMELIT, INCLUDING BUT NOT LIMITED TO THE FOLLOWING COMPONENTS.

- 1) DOOR STATION: INTERCOM BUZZER UNIT WITH VIDEO CAMERA, WITH ALUMINUM OR STAINLESS STEEL COVER PLATE. AIPHONE JK-DV OR EQUIVALENT. WEATHER RESISTANT COVER PLATE FOR EXTERIOR STATION.
 - 2) MASTER STATION: MASTER VIDEO STATION WITH PICTURE MEMORY, DOOR STRIKE RELEASE TOGGLE OR SWITCH, TABLE TOP MOUNTED AT RECEPTION DESK. AIPHONE JK-1MED OR EQUIVALENT.
 - 3) POWER SUPPLY: PS-1820UL POWER SUPPLY
3. CONTROLLED ACCESS SYSTEM DEVICES PROPOSED SHALL BE COMPLETE, WITH ALL NECESSARY COMPONENTS; TO INCLUDE BUT NOT LIMITED TO POWER SUPPLIES, CABLES AND CABLING, CIRCUITS IN REQUIRED VOLTAGES, RACEWAYS, BOXES, TRANSFORMERS, CONTACTORS, RELAYS, SOLENOIDS, ELECTRIC DOOR STRIKES, ETC.

FRONT ENTRANCE EAC SEQUENCE OF OPERATIONS

- 1. All front entrance, Reception, vestibule doors remain locked at all times, until released or opened by the EAC controlled doors.
- 2. Visitors to communicate with inside school personnel with the exterior mounted Intercom / Video Camera Unit. For access, inside school personnel will activate and release the entry door electric exit device allowing front entrance and Reception doors to be opened.
- 3. If accessible entry door is required for a visitor; when door access is activated/released by school personnel, visitor will push exterior mounted auto door opener actuator pad for auto door opener to activate front entry door automatic swing open.
- 4. Employees will activate and release front entrance door with exterior mounted Card/Proximity Reader Units. Activate vestibule door and Reception door with wall mounted or frame mounted Card/Proximity Reader Units.
- 5. If accessible entry door is required for an employee; when door access is activated/released by exterior mounted Card/Proximity Reader Unit, employee will push exterior mounted auto door opener actuator pad for auto door opener to activate front entry door automatic swing open.

PART 3 - EXECUTION

GENERAL:

Consult project drawings and details and otherwise become familiarized with work so that all items furnished will conform to openings to which applied.

Coordinate hardware with other allied trades such as carpentry, millwork, metal frames, etc.

Prepare and submit to Architect for approval as promptly as possible three (3) copies of completed detailed schedule.

Immediately after award of hardware contract, request approved shop drawings from such trades with which hardware must be coordinated.

After checking approved shop drawings, supply promptly such template information, template drawings, approved hardware schedule, etc., as may be required to facilitate progress on job.

PRE-INSTALLATION CONFERENCE AND TRAINING:

Prior to installation of any hardware, conduct pre-installation conference with Architect representative, Owner representative, hardware distributor representative, and installation crew members to verify installation and adjustment techniques and directions. Installation personnel shall be currently certified by Allegion for LCN door closer and Von Duprin exit device installation and adjustment. Allegion will provide and conduct mandatory training courses for installers.

APPLICATION:

Apply hardware in accordance with approved Shop Drawings, with fastenings of proper size, quantity, and finish, and in accordance with Manufacturer's instructions coordinate.

Operation: All items of hardware shall fit and operate properly.

HARDWARE LOCATIONS:

Door Pulls: 42" from finished floor to center of grip.

Push-Pull Bar: 42" from finished floor to center of bar of center between bars and combination.

Top Hinge: To frame Manufacturer's standard, but not greater than 10" from head of frame to centerline of hinge.

Bottom Hinge: To frame Manufacturer's standard but not greater than 12-1/2" from finished floor to centerline of hinge.

Intermediate Hinges: Equally spaced between top and bottom hinge.

Locks and Latches: 38" from finished floor to center of knob.

Deadlocks (with separate latch-set and/or pull): 48" from finished floor to centerline of strike.

Locate pivots in accordance with Pivot Manufacturer's requirements.

FINAL INSPECTION: After installation of all finish hardware is completed, and before building is accepted, General Contractor shall have capable representative of hardware manufacturers, minimum of an AHC, visit building to inspect and approve installation; to make all necessary adjustments; and to carefully instruct Owner in proper use, servicing, adjusting and maintaining of hardware.

SIX MONTH SERVICE AND REPORT: Six months after acceptance of each area of the project, readjust each item of hardware and restore to proper function. Install fixed locking screw in strike plate for exterior locksets after final adjustments made during 6-Month Service and Adjustment Inspection, and include confirmation statement in the written report. Conduct walk through with Owner regarding recommended additions or modifications to maintenance procedures. Clean and lubricate as required. Replace items, which have deteriorated or failed due to faulty design, materials, or installation. Provide Architect with written report upon completion of above, with list of attendees.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

SUMMARY:

Provide glass and glazing and special fire glass as indicated below, complete.

Work Included This Section:

Glass and Glazing For:

- Aluminum Entrances
- Steel and Wood Doors
- View Windows and Panels
- Curtain Walls
- Exterior Windows
- Special fire glass, frames and doors

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Section 01068.

QUALITY ASSURANCE:

Provide safety glass (tempered, laminated, impact resistant) as required by the IBC Code, and complying with requirements of ANSI Z97.1 - American National Standard for Glazing Materials Used in Buildings -- Safety Performance Specifications and Method of Test.

Label each piece of glass designating type and thickness of glass. Do not remove label prior to installation.

Permanently identify each unit of tempered glass. Etch or ceramic fire identification on glass; identification shall be visible when unit is glazed.

Warranty: Provide manufacturer's standard 10 year warranty, including include replacement of sealed glass units exhibiting seal failure or leakage, interpane dusting or misting.

Manufacturers:

Standard: For purposes of designating type and quality for work under this Section, Drawings and Specifications are based on products manufactured or furnished by following manufacturers:

- American St. Gobain Corporation

- Libby-Owens-Ford Glass Company
- Mississippi Glass Company
- Pittsburg Plate Glass Company
- Technical Glass Products
- Nippon Electric Glass Co., Ltd.
- Pilkington

SUBMITTALS:

Glass and Glazing: Submit samples of each type of glass, glazing compound, sealant and tapes for Architect's approval.

Product Data: Submit copy of manufacturer's specifications and installation instructions for each type of glass and glazing material. Include test data or certification substantiating that glass complies with specified requirements and manufacturer's warranties.

Submit manufacturer's standard 10 year warranty for insulated glass units.

MANUFACTURER'S LABELS:

Labels showing Glass Manufacturer's identity, type of glass, thickness and quality will be required on each piece of glass. Labels must remain on glass until it has been set and inspected.

Containers: All glazing compounds shall arrive at project site in unopened, labeled containers.

PRODUCT HANDLING:

Sizes of glass indicated on Drawings are approximately only. Determine actual size required by measuring frames to receive glass at project site, or from guaranteed dimensions provided by Frame Supplier.

Cutting: All glass shall be cleancut. Nipping to remove flares or to reduce oversized dimensions of any type of glass will not be permitted.

Deliver glass to site in suitable containers that will protect glass from weather and from breakage. Store material in safe place to minimize breakage, but deliver sufficient glass to allow for normal breakage.

DESIGN AND PERFORMANCE REQUIREMENTS:

Watertight and airtight installation of each piece of glass is required. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating doors) without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials, and other defects in work.

PART 2: PRODUCTS

GLASS:

Tinted Solar Control Low-E Insulating Glass: Unless otherwise noted, 1" thick panels; 1/4" thick "deep cool-grey" low-reflective body-tinted float glass to exterior, 1/4" clear Low-E solar control glass to interior; Low-E shall be on the 3rd surface, with 1/2" space between glass panes by dessicant filled spacer and sealant device.

Exterior Glazing: Pilkington SuperGrey / Energy Advantage

Properties: Pilkington SuperGrey / Energy Advantage Low-E Glass

Glazing:	Exterior
Type:	Insulated
Total Thickness:	1" (24 mm)
Space Filler:	Dehydrated Air Space
Outboard Lite:	1/4" SuperGrey Tinted Float Glass
Inboard Lite:	1/4" Energy Advantage Low-E Glass, #3 Surface
Low-E Surface:	3 rd Surface

Heat Strengthened:	Safety as required – see elevations
Tempered:	Safety as required – see elevations

Visible Light Transmittance (%):	LT 7%
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Visible Lite Exterior Reflectance (%):	LRO 4%
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Visible Lite Interior Reflectance (%):	LRi 13%
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Total Solar Energy Direct Transmittance (%):	ET 5%
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Total Solar Energy Reflectance (%):	ER 4%
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U-V Transmittance (%):	UV 1%
Solar Heat Gain:	SHGC 0.15
Shading Coefficient:	TSC 0.18

Spandrel Glass: Spandrel glass at locations indicated shall be obscure ceramic coating on #4 surface.

Exterior Aluminum Entrance Doors: 1/4" Pilkington SuperGrey Low-E tempered safety glass, impact resistant as required.

Fire Rated Glass, Aluminum Doors and Frames: Where indicated, provide fire-rated impact resistant glass, doors and frames for protected openings as indicated on Drawings, equivalent to "Pyrostop" glass and "FIREFRAMES", "Heat Barrier Series", manufactured by Technical Glass Products. Conform to UL 10 C, UBC 7-2, and UBC 7-4, UL File No. R-19207, design U533. Frame tests to pass ASTM E-119, NFPA 251, UL 263, UL 9, UL 10C, UBC 7-2 and UBC 7-4.

Provide safety glass throughout as required by the IBC Code, and ANSI Z97.1 - American National Standard for Glazing Materials Used in Buildings -- Safety Performance Specifications and Method of Test.

Interior Doors Throughout: 1/4" clear tempered safety glass, impact resistant as required.

Interior Windows Throughout: 1/4" clear tempered safety glass, impact resistant as required.

SETTING BLOCKS AND SPACER SHIMS:

Fabricate blocks and shims from neoprene. Shape to required size and thickness. Material used for blocks and spacers must be compatible with type of compounds and sealants used and shall not cause staining or discoloration of sealant or frame.

Shore A durometer hardness of setting block and shim material shall be 70 to 90 points for setting blocks and 50 points for spacer shims, or as recommended by compound or sealant manufacturer.

GLAZING MATERIALS:

Sealant and Compound shall be Vulkem 116 by Master Mechanics Company, Maccolastic Acrylic Compound by Macco Division, Glidden Company, Betaseal 850 by Essex Chemical Company or approved equal.

Glazing Tape shall be butyl rubber sealant type partly vulcanized, self-adhesive, non-staining, elastomeric butyl rubber tape, complying with AAMA 800.

Bestaseal 650 Tape by Essex Chemical Company
Duraribbon 1070 by PPG Industries
176 Strucsureglaze by Protective Treatments Company

Compatibility: Where combination of sealing materials is required for glazing in same frame, manufacturer shall certify that all glazing materials furnished are compatible with each other and compatible with material used for setting blocks and spacer shims.

PART 3: EXECUTION

CONDITION OF SURFACES:

Preparation: Check all frames prior to glazing. Openings shall be square, plumb, and with uniform face and edge clearances. Maintain 1/8" minimum bed clearance between glass and frame on both sides.

Clean all surfaces to be glazed with xylol, a 50-50 mixture of acetone and xylol, or other solvents recommended by compound or sealant Manufacturer. Any defects affecting satisfactory installation of glass shall be corrected before starting of glazing.

Temperature: Do not apply any compound or sealant at temperatures lower than 40 degrees F.

INSTALLATION:

Workmanship: Apply glazing compound uniformly with accurately formed corners and bevels. Remove excess compound from glass and frame. Use only recommended thinners, cleaners and solvents. Do not cut or dilute glazing compound without approval from Architect. Make good contact with glass and frame when glazing and facing off.

Cleaning: Compound shall be removed from glass before it hardens. Remove any excess sealants from glass and adjoining surfaces during working time of material, within two to three hours.

Blocks and Spacers: Where setting blocks and spacer shims are required to be set into glazing compound or sealant, they may be butted with compound or sealant, placed in position, and allowed to set firmly prior to installation of glass.

Miscellaneous Interior Glazing: Unless otherwise indicated, all interior glass shall be channel glazed with glazing compound. Apply as follows:

Apply ample back compound to rabbet so that it will ooze out when glass is pressed into position and completely cover glass in rabbet. Press glass into position.

Secure glass in place by application of stop beads. Bed stop beads against glass and bottom of rabbet with compound, leaving proper thickness between glass and stop beads. Secure stop beads in place with suitable fastenings. Strip surplus compound from both sides of glass and tool at slight angle to provide clean sight lines.

Glazing Aluminum Entrances and Window Wall System:

Glass shall be set in accordance with aluminum entrances and window walls Manufacturer's approved shop drawings and instructions.

Install moldings level, plumb and square. Moldings at corners shall be accurately cut, neatly fitted, and joined as recommended by Storefront manufacturer.

REPLACEMENTS AND CLEANING:

Condition: At completion of work, all glass shall be free from cracks, sealant smears and other defects.

Protection/Replacement: Protect glass surfaces and edges during the construction period. Keep glass free from contamination by materials capable of staining glass. Any glass that is defective before acceptance, or within one year warranty period, as result of manufacturing, transporting, or performance of Contractor, shall be removed and replaced with new glass without cost to Owner.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

1.1 SECTION INCLUDES

- A. Formed metal stud framing at exterior and interior wall locations, complete systems.
- B. Metal stud framed items and areas.
- C. Framing accessories

1.2 REFERENCES

- A. ASTM A123 — Zinc (Hot—Dip Galvanized) Coatings on Iron and Steel Products.
- B. ASTM A525 — General Requirements for Steel Sheet, Zinc—Coated (Galvanized) by the Hot—Dip Process.
- C. ASTM A591 — Steel Sheet, Cold—Rolled, Electrolytic Zinc—Coated.
- D. ASTM C645 — Non-Load (Axial) Bearing Steel Studs, Runners (Track) and Rigid Furring Channels for Screw Application of Gypsum Board.
- E. ASTM C754 — Installation of Steel Framing Members to Receive Screw—Attached Gypsum Wallboard, Backing Board, or Water—Resistant Backing Board.
- F. GA 203 — Installation of Screw—Type Steel Framing Members to Receive Gypsum Board.
- G. Metal Framing Manufacturers Association (MFMA) — Guidelines for the Use of Metal Framing.
- H. SSPC (Steel Structures Painting Council) — Steel Structures Painting Manual.

1.3 SYSTEM DESCRIPTION

- A. Metal stud framing system for exterior walls shall be 6" or 8" x 54 mil minimum structural studs, as noted on Drawings, as manufactured by Marino\Ware, Dietrich, Unimast, Clark Metal Framing Systems or approved equal. Refer to Drawings for metal stud sizes and thickness.
- B. Refer to drawings for interior metal stud sizes and gauges.
- C. Design and size connection components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with the North Carolina State Building Code wind loading requirements.
- D. Maximum Allowable Deflection: 1/600 span.
- E. System to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
- F. Wall studs shall align in straight and true lines.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, type and location of fasteners, and accessories or items required of other related work. Show methods for allowances of deflection of building structural members.
- B. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement to framing connections.
- C. Product Data: Provide data describing standard framing member materials and finish, product criteria, load charts, limitations.
- D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with MFMA and ASTM C754.

1.6 QUALIFICATIONS

- A. Installer: Company specializing in performing the work of this section with minimum five years documented experience.

1.7 COORDINATION

- A. Coordinate with all trades the placement of components within the stud framing system to provide a totally sound and complete system installation ready to receive sheathing and wallboard.

PART 2: PRODUCTS

2.1 STUD FRAMING MATERIALS

- A. Studs: ASTM A525, ASTM A591, cold rolled steel, channel shaped, punched for utility access
 - 1. Depth: 8", 6", 3 5/8" as shown on the drawings.
 - 2. Thickness: 54 mil minimum for 8" and 6" studs and 33 mil minimum for 3 5/8" studs.
 - 3. Width minimum 1 5/8" with 1/2" stiffening return both flanges.
- B. Runners: Of same material and thickness as studs unless otherwise noted.
- C. Furring and Bracing Members: Of same material as studs; thickness to suit purpose.
- D. Fasteners: Stainless steel or zinc coated #12 pan head, self-drilling, self-tapping screws.
- E. Anchorage Devices: Powder actuated fasteners and screws as shown on drawings.
- F. Touch—Up Primer for Galvanized Surfaces: SSPC — Paint 20 Type I Inorganic.

2.3 FABRICATION

- A. Fabricate assemblies of framed sections to sizes and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.
- B. Fit and assemble in largest practical sections for delivery to site, ready for installation.
- C. Studs shall bear tightly against the top and bottom track.

2.4 FINISHES

- A. Studs: Galvanize to G60 coating class.
- B. Tracks and Headers: Galvanize to G60 coating class.
- C. Accessories: Same finish as framing members.

PART 3: EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are ready to receive work.
- B. Verify that rough—in utilities are in proper location.

3.2 ERECTION

- A. Align and secure top and bottom runners.
- B. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- C. Install studs vertically uniformly at the spacings shown on the drawings.
- D. Align stud web openings horizontally.
- E. Secure studs to tracks using screws or welding.
- F. Stud splicing not permissible.
- G. Fabricate corners using a minimum of three studs.
- H. Minimum double stud at wall openings, door and window jambs, not more than 2 inches from each side of openings. Refer to drawings for additional jamb and head conditions.
- I. Brace stud framing system rigid.
- J. Coordinate erection of studs with requirements of doorframes, window frames, and; install supports and attachments.
- K. Coordinate installation of wood bucks, anchors, and wood blocking with electrical and mechanical work to be placed within or behind stud framing.
- L. Blocking: Secure wood blocking to studs. Secure steel channels to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, etc. as required by Architect.

- M. Coordinate placement of insulation in stud spaces made inaccessible after stud framing erection.
- N. Fabricate and install headers at openings as indicated on drawings.
- O. All multiple members shall be stitch welded together with 1" seam welds spaced at 16" oc maximum both sides of members to form a totally composite member. Multiple members in composite units shall not be spliced.
- P. All connections not shown on the drawings shall be designed by the supplier to support the imposed loads.
- Q. Provide continuous 2" x 43 mil horizontal strap bridging at 48" maximum intervals on both flanges. Install with 1 screw per stud. Provide solid blocking using a piece of metal stud between studs at each end of bridging run and at 12' oc maximum. Terminate bridging at wall openings with solid blocking bridging as required.
- R. Place one stud tightly against each side of the tubular steel columns in line with the wall. Align the face of stud flush with face of tubular columns for smooth finish application for dry wall and sheathing. Fasten stud to column with powder actuated fasteners spaced at 16" oc.

3.3 ERECTION TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation of any Member from Plane: 1/4 inch.
- C. Maximum Variation From Plumb: 1/4 inch in 10' height.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Under this Section, provide gypsum board for walls, partitions, ceilings, ceiling access doors and fireproofing for beams and columns as indicated on drawings and as specified herein.

Note all gypsum drywall, except as noted on drawings and with exception of walls scheduled for vinyl wall covering and the Flex Lab 133 Green Screen Wall, shall be provided with a fine textured spray applied finish, applied prior to coats of paint, matching USG "Orange Peel" texture.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers:

Standard: For purposes of designating type and quality for work under this Section, Drawings and Specifications are based on products manufactured or furnished by United States Gypsum Company.

Acceptable Manufacturers: Products of following manufacturers which meet all requirements of these specifications will be acceptable:

- U.S. Gypsum
- Celotex Corporation
- G-P / Bestwall Div. of Georgia-Pacific
- Johns-Manville
- National Gypsum Company

Source: Products for use on this Project shall be of one Manufacturer for same function, unless noted specifically otherwise herein.

SUBMITTALS:

Manufacturer's Data: Submit (in duplicate) Manufacturer's printed catalog cuts, installation instructions, and finishing instructions.

Test Reports: Submit (in duplicate) reports from Underwriter's Laboratories, Inc. or other acceptable testing agencies, on fire tests of designs referred to in Contract Documents.

Mock-up Sample: Fabricate a field sample mock-up of gypsum wallboard with the specified "orange peel" texture applied, for review and approval by Architect. Approved mock-up will stand on site for reference as the project standard for all orange peel textured walls.

Mock-up Sample: Fabricate a field sample mock-up of gypsum wallboard aluminum reveals, for review and approval by Architect. Approved mock-up will stand on site for reference as the project standard for all aluminum reveal walls.

PRODUCT HANDLING:

Delivery: Deliver materials in original packages, containers or bundles bearing brand name and name of manufacturer or supplier for whom product is manufactured.

Storage: Gypsum board and insulation material delivered prior to use shall be stored within completely weather tight structure, off ground, and completely enclosed within weather tight covering. Stack all board materials on 2"x 4" risers, spaced 16" o.c. Weather tight covering shall also extend completely under stacked material to prevent seepage of moisture if over uncovered ground or damp slab.

Handling: Exercise care, during handling and storage, to avoid undue sagging or damage to edges, ends, and surfaces.

ENVIRONMENTAL CONDITIONS:

Building: Application of gypsum board shall commence only after structure is completely weather -tight.

Temperature: In cold weather and during period of gypsum board application and joint finishing maintain temperatures in building uniformly within range of 55 degrees to 70 degrees F. Provide adequate ventilation to eliminate excessive moisture in building during same period.

PART 2: PRODUCTS

MATERIALS:

Gypsum Board shall be furnished in 48" widths and in lengths of at least 2" greater than height from floor to finished ceiling to permit vertical installation of all boards. Contractor shall have option to furnish boards for vertical installation full height to structure above where required in one sheet, 48" wide.

Types: Gypsum Board shall conform to following:

1. Gypsum Board shall be fire-resistive type throughout of various thicknesses indicated, equivalent to Sheetrock Brand Firecode C. Provide impact resistant gypsum wallboard at locations indicated on Drawings.
2. All 5/8" thick gypsum board shall be taper-edged, fire-resistive, conforming to ASTM C 36.
3. Water-Resistant Gypsum Board shall be "Sheetrock W/R/Gypsum Wallboard" 5/8" tapered-edge with treated manila paper finish and "Sheetrock W/R Fire-code C Wallboard, 5/8" tapered-edge with treated manila paper finish for 1 hour rated partitions. Use 5/8" water-resistant gypsum board for ceilings of janitor closets, shower rooms, tub rooms.
4. Tile Backer Board: Use 5/8" tile backer board for backup of all areas scheduled to receive thin set ceramic tile. Moisture resistance silicone core reinforced with inorganic glass fiber matt. "DenShield Tile Guard" by Georgia-Pacific, or equal approved by Architect.
5. Exterior Wall Sheathing Board shall be 5/8" thick fire retarding fiberglass reinforced gypsum board with taped joints: "Dens-Glass Gold" by Georgia-Pacific, or equal approved by Architect.

6. Gypsum Soffit board shall be 5/8" thick, fire coded, exterior gypsum soffit board by Bestwall, U. S. Gypsum, or approved equal.
7. Wall Spray Texture: SHEETROCK Wall & Ceiling Spray Texture, SHEETROCK Wall & Ceiling Texture (TUF-TEX), SHEETROCK Wall & Ceiling Spray Texture – Ready Mixed.

FASTENERS:

Screws for attachment of board to metal studs and metal ceiling and wall furring shall be 7/8" or 1" US Drywall Screw, Type S. All screws shall have bugle head.

METAL AND PLASTIC CORNER BEADS AND TRIM:

Interior Work:

Plastic: All external corners are to be bullnozed radius trimmed unless otherwise indicated.

Metal: Fabricate metal corner beads from galvanized steel, not lighter than 0.02" nominal thickness, in following shapes and sizes.

1. Corner Beads for all 90 degree external corners shall be USG No. 100-Perf-A-Bead.
2. Corner Beads for all radiused external corners shall be heavy duty plastic, No. BCB100, radiused bullnoze corner bead by Vinyl Corporation or equal.
3. Metal Trim shall be USG 200 Series Perf-A-Trim, sized for wallboard thickness.
4. Anodized Aluminum Reveals: Continuous anodized aluminum reveals shall be provided in profile and layout indicated on Drawings, with factory fabricated intersections. Install or provide mock-up installation samples for Architect's review and obtaining final approval prior to proceeding with installations. Fry Reglet or equivalent.

REINFORCING TAPE AND JOINT TREATMENT (INTERIOR)

Tape shall be "Perf-A-Tape", or approved equal.

Compound for embedding and fill coat application shall be "Perf-A-Tape Joint Compound".

Compound for finishing shall be "Perf-A-Tape Topping Compound".

ADHESIVE AND CAULKING:

Laminating Adhesive: Laminating adhesive for face layer application in double-layer systems shall be "Perf-A-Tape Joint Compound, embedding type".

Caulking Compound: Acoustical type sealant, furnished by Gypsum Board products manufacturer.

CRACK CONTROL JOINTS:

Crack control joints shall be provided in pre-approved locations as directed by the Drawings and the Architect, at each jamb of windows exceeding 10' in width, walls at 40' intervals, and ceilings at 30' intervals. Provide manufacturer standard metal exp/control joint material.

PART 3: EXECUTION

CONDITION OF SURFACES:

Inspection: Examine surfaces to receive gypsum board for defects, which might impair quality of finished installation. Do not start work until such defects have been corrected.

Framing Spacing: Framing members to which gypsum board will be fastened shall be straight and true, and spaced as indicated on Drawings, not to exceed 16" o.c. for walls and ceilings. Framing and bridging members shall be adequate to carry design or code loading. Bridging members shall be spaced 48" o.c.

Supplemental Framing: Provide back blocking and framing as necessary for support of fixtures and all mounted equipment.

Coordination: Conduit, piping, retainers for corner guards and other items to be concealed by or penetrating, wallboard shall be installed and tested before applying wallboard.

INSTALLATION OF GYPSUM BOARD:

Cutting and Fitting:

Cut gypsum board by scoring and breaking, or by sawing. Work from face side.

Cut edges and ends of gypsum board shall be smoothed where necessary, in order to obtain neat jointing when board is erected.

Cut-outs for pipes, fixtures or other small openings shall be scored on face and back in outline before removal, or shall be cut out with saw or other suitable tools.

Where gypsum board meets projecting surfaces, scribe and cut neatly, fitting closely for caulked joint.

Application of Gypsum Board:

Apply continuous bead of Acoustical Sealant on floor at line of contact of board.

Walls: Apply gypsum board vertically, pressing into sealant, with boards in moderate contact, but not forced into place. At interval and external corners conceal cut edges of boards by overlapping covered edges of abutting boards. Arrange joints on opposite sides of partitions so as to occur on different framing members. Place long dimensions of panels parallel to furring or framing members. Panels shall be of length required to reach from 2" above ceiling line to floor line in one continuous length. Make joints over framing or furring members.

Ceilings: Apply board to ceilings with long dimension of board at right angles to furring members. At perimeters of all ceilings, edge joint shall be laid on metal trim strip against continuous bead of caulking, applied in advance of board application.

Gypsum Board End Joint at masonry walls shall be laid on metal trim strip against continuous bead of caulking, applied in advance of board application.

Corner Beads and Metal Trim: Internal corners do not require corner beads, but shall be reinforced with tape. External corners shall have corner bead fitted neatly over corner, and secured with same type fasteners used for applying wallboard.

ATTACHMENT:

Method: Space fasteners not less than 3/8" nor more than 1/2" from edge and ends of board. While fasteners are being driven, hold board in firm contact with under laying support. Application of fasteners shall proceed from central portion of board to ends and edges. If paper surface is broken by fastener in attachment, drive another fastener approximately 2" from faulty fastener.

Drive screws to provide screw head penetration just below gypsum board surface.

Spread adhesive over laminating surface of face or base layer gypsum board. Extend adhesive up to ends and edges of all board.

Spacing of Fasteners shall be as follows:

Screw Method: Space screws at maximum of 12" o.c. for ceilings and 16" o.c. for walls.

Corner Beads and Trim shall have fasteners spaced 6" o.c. driven through gypsum board into framing members.

JOINT FINISHING AND FASTENER CONCEALMENT:

Provide "LEVEL 4" gypsum wallboard finish at all areas, unless indicated otherwise.

Provide "LEVEL 5" gypsum wallboard finish without orange peel spray texture on Green Screen Wall in FLEX LAB 133.

Method: Mix and use joint compound and topping compound in accordance with manufacturer's recommendations printed on bag. Apply by machine or hand tool. Allow minimum drying time of 24 hours between adhesive coats. Sand all coats as necessary after each application. Clean excess compound from surface of gypsum board as compound is applied.

Reinforcement: Reinforce wall and ceiling angles and inside vertical corner angles with tape folded to conform to adjoining surfaces, and to form straight, true angle. All gypsum board joints except joints at metal trim shall be tapered.

Embedment Coat: Apply thin, uniform layer of joint compound (embedding type) approximately 3" wide over joint to be reinforced. Center tape over joint and seat into compound; leaving sufficient compound under tape to provide proper bond. Apply skim coat of compound immediately after embedding tape.

Fill Coat: After drying, cover embedding compound with fill coat of compound. Spread evenly over and slightly beyond tapered edge area of board. Feather at edges.

Topping: Cover fill coat with topping compound. Spread evenly over and slightly beyond edge of proceeding coat. Feather with smooth, uniform finish.

Fastener Concealment: Treat dimples at fasteners (and holes where temporary fasteners are removed) with three coats of joint compound applied as each coat is applied to joints.

Conceal flanges of all corner beads and trim members by minimum of two coats of compound applied strictly in accordance with Manufacturer's directions.

Caulking:

Joints at Penetrations: Where pipes, conduits, ducts, electrical devices, etc., penetrate gypsum board, seal joint around perimeter with caulking compound.

Joints between ceilings and walls shall be sealed continuously with acoustical sealant, as specified above.

Exterior Wall Sheathing Board joints shall be taped with manufacturer's recommended weather resistant adhesive tape. This does not replace or supercede any requirements for building wraps or felt layers required in cavity walls.

CEILING ACCESS DOORS: Provide 24" x 24" x 16 gauge minimum primed steel ceiling access doors each space with drywall ceiling, hinged and with key lock. Provide UL Listed fire rated doors all locations where rating is required. Recessed faces of access doors shall be filled with gypsum board to match adjacent ceilings. Secure 1/2" resilient furring channels 16" o.c. to face of door with sheet metal screws. Screw 1/2" thick gypsum board to channels as specified hereinbefore. Provide USG No. 200-B metal trim on all edges of gypsum board. Finish as specified hereinbefore.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work under this section includes providing metal stud partition system, metal ceiling furring system, metal wall furring system and metal ceiling suspension system, for installation of gypsum board.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers:

Standard: For purposes of designating type and quality for work under this Section, Drawings and Specifications are based on products manufactured or furnished by United States Gypsum Company.

Acceptable Manufacturers: Products of following manufacturers, which meet all requirements of these specifications, will also be acceptable:

- Celotex Corp.
- Flintkote Co.
- GP/Bestwall Div. of Georgia-Pacific Co.
- Johns-Manville
- National Gypsum Co.

Source: Products for use on this Project shall be of one manufacturer for same function, unless noted specifically otherwise herein.

SUBMITTALS:

Shop Drawings: Show complete details of construction, including gauges of metal, anchors, fastenings, special fittings, and accessories. Show ceiling framing and furring, special wall framing, and framed openings.

Manufacturer's Data: Submit (in duplicate) Manufacturer's printed data on materials and installation for work specified herein. Include reports on fire tests and physical data.

PRODUCT HANDLING:

Delivery: Deliver materials to Project site in the original packages, containers or bundles, bearing brand name, and name of manufacturer or supplier for whom product is manufactured.

Storage: Store materials to prevent damage from exposure to elements.

PART 2: PRODUCTS

METAL STUD PARTITION SYSTEM: Metal stud partition system shall be USG Metal Stud System, or approved equal, designed for screw attachment of gypsum board, furnished with required fasteners and accessories for complete system.

Steel Studs shall be C-shaped, formed from not less than 20-gauge galvanized steel sheets, USG width as shown on drawings. Stud webs shall have punched holes throughout for utility lines or wiring.

Metal Floor and Ceiling Runners shall be channel-shaped, formed from not less than 25-gauge galvanized steel sheets, with minimum 1-1/4" flanges and web-sized to nest with steel studs specified.

Screws for attachment of studs to runner and other framing fastening where specified shall be 3/8" USG Drywall Screw, Type S, pinhead.

WALL FURRING SYSTEM: Wall furring system shall be USG Drywall Wall Furring System, designed for screw attachment of gypsum board furnished with required fasteners and accessories for complete system.

Furring Channels shall be hat-shaped USG Drywall Furring Channels, or equal, roll-formed from not less than 25-gauge galvanized steel, 2-3/4" wide by 7/8" deep with 1/2" minimum wing flanges and 1-3/8" minimum crown width for gypsum board attachment.

Fasteners for attachment of furring channels (or wall furring brackets) shall be as recommended by furring manufacturer.

Brackets for furred-out utility space shall be USG adjustable wall furring brackets, formed from not less than 20-gauge galvanized steel. Horizontal leg shall have serrated edges for wire-tie of carrying channels.

Carrying Channels shall not be less than 16-gauge cold-rolled channels, 3/4" web width and 1/2" flange depth, spaced 48" on center maximum. Finish with black asphaltum.

Tie Wire shall be not less than 16-gauge soft annealed carbon steel wire.

CEILING FRAMING SYSTEM: Ceiling-framing system for furred and suspended gypsum board ceilings shall be USG Drywall Ceiling System, designed for screw attachment of gypsum board, furnished with required fasteners and accessories for complete system.

Furring Channels for gypsum board applied to ceiling framing shall be hat-shaped USG Drywall Furring Channels, roll-formed from not less than 25-gauge galvanized steel, 2-3/4" wide by 7/8" deep with 1/2" minimum wing flanges and 1-3/8" minimum crown width for gypsum board attachment. Provide cross-carrying channels as specified at 48" centers.

Furring Channels for dropped ceilings, soffits, and where indicated at expansion joints shall be C-shaped studs, formed from not less than 25-gauge galvanized steel sheets, and of sizes indicated on Drawings.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Provide acoustical ceiling systems, complete as shown and as specified herein, including exposed tee suspension systems and acoustical lay-in boards.

Coordinate work with installation of air conditioning grilles and diffusers specified in Division 15B and with installation of lighting fixtures specified in Division 16.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers:

Standard: For purposes of designating type and quality for work in this Section, Drawings and Specifications are based on products by following manufacturers:

Ceiling Suspension Systems shall be by one of following, or equivalent by:

- Chicago Metallic Corp.
- Eastern Products Corp.
- Donn Products, Incorporated

Acoustical Tiles shall be Rockfon (mineral wool) ASTM E1264 Class A, or equivalent products by:

- BPB
- Armstrong
- USG

Source: Products for use on this Project shall be of one Manufacturer for each function.

Shop Drawings: Indicate following:

Layout of inserts required for ceiling suspension system.

Reflected ceiling layouts for all areas to receive acoustical ceilings. Details of all connections to work of other trades.

Submit typical layout showing size and spacing of exposed grid and hangers as related to structural frame.

Samples: Submit samples of each acoustical unit, suspension system, and accessories.

Test Reports: Submit (in triplicate) copies of certificate of maximum Flame Spread Class 25 rating under requirements of SS-S-118A, required for all acoustical units on Project.

Manufacturer's Data: Submit (in triplicate) Manufacturer's printed installation instructions for suspension system.

Warranty: Provide 15 year "humidity no-sag" manufacturer's warranty for tiles and grid system, warranted to replace tiles and damaged or defective system components at no cost to owner if tiles sag visibly within the warranty period.

PRODUCT HANDLING:

Delivery: Deliver acoustical ceiling boards to Project site in Manufacturer's original packages, with seals unbroken, with Manufacturer's name and contents legibly marked thereon and with testing laboratory labels where required.

Storage: Store ceiling tiles and boards in enclosed areas, with same temperature and humidity conditions as areas in which material is to be installed.

ENVIRONMENTAL CONDITIONS:

Building Conditions: Install acoustical materials only when normal temperature and humidity conditions approximate interior conditions that will exist when building is occupied. Building shall not be cold and damp, or hot and dry.

Glazing shall be in place and all exterior openings closed. All concrete, plastering and other wet work shall be complete and dry.

Provide heat and ventilation to maintain proper conditions before, during, and after acoustical work is performed.

PART 2: PRODUCTS

TYPES AND SYSTEMS: All acoustical materials shall be of types indicated by type numbers on Drawings, as follows:

Type 1: 24" x 24" x 5/8" Rockfon Artic 600 Square Lay-in / Chicago Metallic 200 Snap Grid 15/16"

Type 2: 24" x 24" x 5/8" Rockfon Artic 660 Square Tegular / Chicago Metallic 200 Snap Grid 15/16"

Type 3: 24" x 24" x 1/2" Vinyl faced gypsum panels, with white stipple finish / Chicago Metallic 830 All Aluminum Grid 15/16"

Type 4: 5/8" Moisture resistant gypsum board on hat channels/cold-rolled channels framing system.

Type 5: 5/8" Firecode gypsum board on hat channels/cold-rolled channels framing system. Smoke resistant construction.

Type 6: 5/8" Gypsum board on hat channels/cold-rolled channels framing system.

HANGERS:

Wire: No. 12 gauge galvanized steel.

SUSPENSION SYSTEM:

Components: System shall consist of main support tees, cross tees, splice clips, wall angles, and hold down clips.

Design Loads: Suspension system shall be designed to support respective lay-in units and light fixtures with deflection of suspension members not to exceed 1/360 of span of member.

Exposed Grid System: Chicago Metallic Grid System (hot dipped galvanized steel), consisting of main tees and cross tees with 15/16" exposed flange. Wall molding shall be cold-rolled galvanized steel, channel shaped, with 1" exposed face of same finish as exposed tee surfaces.

Provide all aluminum grid at locations indicated, and food service areas.

Provide bullnosed preformed corners for bullnosed wall corners, and around steel tube columns.

Finish: Exposed surfaces of tees and of wall moldings shall be flat white, baked polyester.

PART 3: EXECUTION

INSTALLATION OF ACOUSTICAL CEILING SYSTEMS:

General Requirements:

Suspension System: Install strictly according to approved Shop Drawings layouts for spaces and manufacturer's printed instructions.

Ceiling Tile Pattern, Layout, and Type:

1. Install acoustical ceiling in patterns and types indicated on approved shop drawings and, as described in this specification.
2. Unless indicated otherwise herein or on Drawings, ceilings shall be laid out symmetrically in each space, with no less than half size panels or tiles at walls.

Installation of acoustical materials and suspension systems shall be made by experienced mechanics in strict accordance with Manufacturer's written instructions.

Fit parts neatly and accurately, true to line and plane.

Where hangers fall at structural members, install hanger clips in strict accordance with written instructions of Manufacturer of hanger clips.

Suspension system, including wall mold, shall be level to within 1/8" in 12 feet, with ceiling panels in place.

Exposed grid members shall be straight and in alignment. All exposed surfaces shall be flush and level.

General Requirements for Acoustical Ceilings:

Scribe lay-in units neatly to abutting surfaces and to penetrations or protrusions.

Exercise care to prevent soiling of ceiling tiles during installation. Leave entire system neatly and accurately fitted.

CLEANING: Following installation, clean all soiled and discolored surfaces. Remove and replace units, which are damaged or improperly installed.

EXTRA STOCK: Furnish Owner 5% of each pattern of acoustical tile installed in Project for maintenance replacements.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

GENERAL:

Stone Association Publications: Comply with recommendations contained in the publications indicated below:

Submittals: With manufacturer's data and installation instructions, submit samples not less than 12" x 12" for each type, color, and finish of stonework units.

PRODUCTS:

Obtain each type of stone from one quarry, with consistent color range and texture, complying with referenced ASTM standards and other references indicated, extracted from a single bed of quarry stratum.

Bluestone Slate: Where indicated on Drawings, provide blue-gray slate window stools and benches as detailed, exposed finished surfaces flat with natural cleft face, one long edge sandrubbed, gauged, and slightly rounded front edge, with exposed edges true, level and square. Equivalent to Buckingham Slate Bluestone window sill stools.

Face Finish: Natural cleft face; dull sheen, without reflections. Color and finish to match Architect's sample. Seal stone with manufacturer's recommended sealer.

Outside 90 degree corners directly adjacent to pedestrian walkway areas, shall be safety bullnosed.

For colored pointing mortar, use ground granite or other sound stone to match Architect's sample.

Dry Set Thin-Set Mortar: ANSI A118.1

Prepackaged dry mortar mix with re-emulsifiable powder as additive, for mixing with water only.

Anchors: Nonferrous metal, as required to suit stone installations.

Fabrication: Precut stone units to required sizes and shapes. Use powered masonry saw for cutting units at site. Avoid use of less-than-half-size units.

INSTALLATION:

General: Do not use stone units with chips, cracks, voids, stains or other surface defects visible in finished work. Clean stone before setting by scrubbing with fiber brushes and water. Wet stone, as required, before setting. Comply with manufacturer's instructions for application of proprietary materials.

Seal exposed surfaces with manufacturer's recommended sealer.

Installation of Interior Wall Facing and Trim: Erect interior wall facing and trim, plumb and true with joints uniform in width and accurately aligned.

Install stone to comply with requirements of referenced ANSI installation specification, and of ANSI A108.10 and TCA "Handbook for Ceramic Tile Installation", respectively, for setting bed type, TCA installation method and grout: Dry-Set Portland Cement Mortar: ANSI A108.5

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Provide FloorScore certified resilient flooring systems as indicated, complete assemblies with wall base and transitions throughout, with all necessary profiles and accessories, for all conditions, as shown on Drawings and as specified herein.

Provide rubber tile, stair tread and nosing, riser, and stringer system complete assemblies with transitions and necessary accessories, as shown on Drawings and as specified herein.

Concrete floors are specified to be finished flat and level under Division 3 requirements.

Skim coat all areas to receive resilient flooring systems complete, with self-leveling smoothing and leveling compound and prepare for installation of finish products scheduled.

At all SOG (slab-on-grade) and SOD (slab-on-deck) areas, apply a moisture barrier primer/sealer coating to all new and existing concrete floor slab substrates complete.

INDUSTRY STANDARDS:

ASTM F 710-05

LEED SC, U. S. Green Building Council

FloorScore Indoor Emissions Testing Program

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Section 01068.

QUALITY ASSURANCE:

Standard: For purposes of designating type and quality for work under this Section, Drawings and Specifications are based on products by following manufacturers or approved equal:

1. Vinyl Composition Tile (VCT):
 - a. Armstrong Cork Company
 - b. Tarkett
 - c. Mannington
2. Linoleum Composition Tile (LCT):
 - a. Forbo Flooring Systems
 - b. Armstrong Cork Company
3. 100% Vulcanized Thermoset Rubber Base and Accessories:
 - a. Roppe Rubber Company
 - b. Flexco Division Textile Rubber Company
 - c. Johnsonite Rubber Company

4. Rubber Tile, Stair Tread and Nosing, Riser, and Stringer system
 - a. Johnsonite Rubber Company
 - b. Roppe Rubber Company
 - c. Flexco Division Textile Rubber Company

SUBMITTALS:

Samples: Submit following samples of materials proposed for use.

Tile: Three sample tiles of each color selected.

Accessories: Three 12" lengths of each of the following:

1. Wall Base
2. Transition Edge Strip
3. Carpet Transition Stop / Reducer
4. Stair Tread and Nosing, Riser, and Stringer system
5. Self Leveling Skim Coating Material

Manufacturer's Literature: Submit (in triplicate) Manufacturer's certificates, MSDS sheets, VOC product data, and printed installation instructions on following:

- Smoothing and Leveling Compound
- Moisture Barrier Primer/Sealer
- Adhesive
- Resilient Flooring Materials
- Rubber Base

CERTIFICATES:

Submit certification from Manufacturer of each specific resilient material assembly, listing adhesives, primers and sealers for subfloors as proposed for use in conjunction with resilient material of this Section. Manufacturer of specific resilient material shall state approval of materials to be used with his materials as listed in certification.

Submit certification from Manufacturer of adhesive for each resilient flooring assembly, approving all primers and sealers proposed for use on new and existing concrete subfloors.

Submit certification from Manufacturer of each resilient flooring material assembly, approving floor leveler and/or floor patch material proposed for use on concrete subfloors.

Submit certification from Manufacturers of each resilient flooring material assembly, approving dry-cleaner and approving non-alkaline cleaning solution proposed for use on resilient flooring.

Submit certification from Manufacturers of all resilient flooring material assemblies that products are sustainable FloorScore certified products, listing all applicable LEED credits made available by certification.

Submit certification from Manufacturers of resilient flooring adhesives are FloorScore certified products, listing all applicable LEED credits made available by certification.

PRODUCT HANDLING:

Store resilient flooring materials as packaged by Manufacturer, in undamaged condition, and with Manufacturer's seals and labels intact. Exercise care to prevent damage and freezing during delivery, handling, and storage. Store materials at Project site at least 24 hours to their installation.

ENVIRONMENTAL CONDITIONS:

Temperature: Materials and area in which materials are to be installed shall be maintained at following temperatures:

For at least 24 hours before installation of material, and continuing for at least 48 hours after installation, maintain temperature at not less than 70 degrees F. to not more than 90 degrees F.

Maintain minimum temperature of 55 degrees F after flooring is installed.

PROTECTION:

Close spaces to traffic in which all resilient flooring is being set and to other work until flooring is firmly set. Where solvent-based adhesives are used, provide safety spark-proof fans and operate. Natural ventilation is inadequate. Smoking shall be prohibited.

MAINTENANCE MANUALS: Provide 3 copies of maintenance manuals for all resilient flooring describing maintenance procedures.

PART 2: PRODUCTS

SMOOTHING AND LEVELING COMPOUND:

Smoothing and leveling compound, provide complete on all concrete subfloors scheduled for resilient flooring systems. Ardex SD-L or equivalent self-leveling product as approved by flooring Manufacturer.

MOISTURE BARRIER PRIMER/SEALER:

Moisture barrier primer/sealer, required for all concrete subfloors, shall be as recommended by adhesives and flooring Manufacturer.

ADHESIVES:

Low emitting adhesive for cementing resilient flooring materials to sub-floors shall be as approved by flooring Manufacturer.

High moisture level rated adhesive for all existing concrete subfloors, for cementing resilient flooring materials to existing sub-floors shall be as approved by flooring Manufacturer.

Low emitting adhesive for wall base shall be as recommended by base Manufacturer.

All adhesives VOC content shall be less than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

All adhesives shall comply with requirements of the South Coast Air Quality Management District (SCAQMD) Rule #1168.

VINYL COMPOSITION TILE (VCT):

Provide Vinyl Composition Tile (VCT) where indicated on Drawings.

Vinyl Composition Tile:

Provide 12 inch by 12 inch 1/8 inch thick, Class 2 thru chip color, Composition 1, Standard EXCELON by Armstrong World Industries.

Resilient flooring of each color and pattern selected in any one area shall be from same lot.

Colors will be selected from Manufacturer's standard colors and patterns of series specified. Up to three accent colors, selected from manufacturer's standard colors, may be selected in a standard block pattern as directed by Architect for each space.

Slip Retardant Resilient Tile Flooring:

Provide Slip-Retardant Tile where indicated on Drawings, and at all interior ramps.

Provide SAFETY ZONE™ Slip-Retardant Tile Flooring manufactured by Armstrong World Industries, Class 2 thru chip color, in minimum of 2 colors selected from manufacturer's standard colors, 1/8 inch, 12 inch x 12 inch, composed of polyvinyl chloride resin binder, plasticizers, fillers, pigment, and grit. Tile shall have a nominal 0.020 inch thick pattern layer containing aluminum oxide grit.

Slip retardant vinyl composition tile properties shall meet size, thickness, indentation, impact, deflection, dimensional stability, resistance to chemicals, squareness, and resistance to heat requirements of ASTM F 1066.

Slip retardant vinyl composition tile shall meet or exceed property ranges suggested by the American with Disabilities Act, and where an added measure of safety is desired.

LINOLEUM COMPOSITION TILE (LCT):

Provide Linoleum Composition Tile (LCT) where indicated on Drawings.

Linoleum Composition Tile:

Provide 13 inch by 13 inch .080 inch thick, thru chip color, Marmoleum Dual Tile manufactured by Forbo Flooring Systems. Wear layer shall be composed of linseed oil, rosin binders, wood flour, limestone, and dry pigments, comprising a through-grain pattern and color uniformly dispersed throughout the entire thickness, on a polyester backing. Factory applied finish shall be a high performance UV cured double layer equivalent to Topshield2. Meeting or exceeding requirements set forth in ASTM F 2195 "Standard Specification for Linoleum Tile Flooring Type 1."

Resilient tile flooring of each color and pattern selected in any one area shall be from same lot.

Colors will be selected from Manufacturer's standard colors and patterns of series specified. Up to three accent colors, selected from manufacturer's standard colors, may be selected in a standard block pattern as directed by Architect for each space.

RESILIENT BASE:

Provide Rubber Wall Base where indicated on Drawings.

100% Vulcanized Rubber Base:

ASTM F 1861, Type TS, Group 1

Set cove type rubber base on hard surfaces and carpet flooring, 1/8" thick, 4" high at all locations. Manufactured by Roppe Rubber Co. or equivalent. Vinyl or part vinyl composition is not acceptable.

Color: BLACK

Provide pre-molded external and internal corners.

Provide pre-molded end stops.

TRANSITION / REDUCER EDGE STRIPS:

Provide complete terminations at all type flooring transitions, to include all perimeters and terminations of all sports flooring, such as rubber or PVC sports flooring to VCT or polished concrete, carpet to VCT, VCT or carpet to sealed or polished concrete. Vinyl thickness to match resilient flooring thickness.

Provide transitions where non-level flooring surfaces meet or terminate. Must comply ADA Guidelines. Height to be coordinated with floor finishes thicknesses.

REDUCER STRIP: 1-1/4" wide with beveled edge, Johnsonite RRS-XX-D or equal. Color selected by Architect.

CARPET-TO-VCT TRANSITION STRIP: Johnsonite CTA-H adapter, color selected by Architect.

STAIR TREAD, RISER, STRINGER AND INTERMEDIATE LANDING TILE SYSTEM:

Rubber stairwell intermediate landings shall be Johnsonite or equivalent Landing Tiles with a .187 thick diamond surface, overall size 24" x 24", color to be selected from manufacturer's standard colors. Provide where indicated.

Where scheduled, provide raised profile one piece stair tread and riser combination, shall be Johnsonite or equivalent VIRTR (for visually impaired) with a 2" wide contrasting strip of carborundum at the nose of the tread. Treads to have a tapering thickness gauge of .210" to .153" across a 13" tread width with a 7" integral riser, with a square nose and 2" hinged drop to accommodate riser angle. Provide matching rubber stringers. Color to be selected by Architect.

STAIR TREAD NOSING:

At stair treads or floor risers receiving VCT, provide profile of nosing that applies to and conforms to the actual stair tread/riser profile, Roppe No. 1 Commercial Stair Nosing or equivalent. Apply rubber base to face of stair riser or floor to conceal face of riser surface.

Provide Roppe #5 Domestic Stair Nosing at Media Center Story Telling Bleachers carpet edge transitions.

PART 3: EXECUTION

CONDITION OF SURFACES:

Requirements: Surfaces to receive resilient flooring shall meet minimum requirements established by ASTM F 710-05 and Manufacturer of flooring. Do not start work until defects have been corrected.

Obtain Architect's representative inspection of substrate prior to application of adhesives and tiles. Do not start work or continue work until inspection items have been corrected.

Tolerances: Subfloor surfaces shall not vary more than $\pm 1/8"$ in any ten-foot dimension. Neither shall they vary at rate greater than $1/16"$ per running foot. Unacceptable conditions shall be corrected by General Contractor.

APPLICATION OF SMOOTHING AND LEVELING COMPOUND:

Apply to cover substrate completely, wall to wall. Pour mixed compound onto substrate and steel trowel and/or float to spread to manufacturer's product minimum thickness ranges. Upon full cure, sand off entire surface and vacuum all areas.

APPLICATION OF PRIMER:

Apply moisture barrier primer/sealer to cover substrate completely. Apply at rate recommended by Manufacturer of resilient flooring.

APPLICATION OF ADHESIVE:

Mix and apply adhesive in accordance with Adhesive Manufacturer's installation instructions. Cover surface evenly with adhesive. Area covered by one application of adhesive shall not exceed maximum working area recommended by Manufacturer. Install resilient flooring within time limits recommended by Manufacturer. If adhesive films over or dries, it shall be removed and area shall be recoated.

INSTALLATION OF RESILIENT TILE FLOORING:

Lay resilient flooring true, level; and with tight, aligned joints, roll flooring in accordance with Manufacturer's directions to assume intimate contact and proper adhesion. Cut resilient flooring to and around permanent cabinets and fixtures.

Align joints with room axis. Center tile work between walls. Except as required in irregularly shaped spaces, no tile shall be less than one half tile width. Lay tile with grain in direction or pattern as directed by Architect.

Obtain Architect's representative inspection of VCT tile installation during installation phases. Do not start work or continue work until inspection items have been corrected.

INSTALLATION OF BASE:

Cement base firmly to wall. Joints shall be tight. Base (throughout its entire length) shall have top and bottom edges in firm contact with walls and finish floors. Form 90 degree internal and external corners and end stops from preformed units. Scribe base accurately to trim.

INSTALLATION OF EDGE STRIPS:

Install edge strips as required at doors and at other locations to provide transition from all finish flooring types to other floor or surface area transitions of dissimilar materials.

CLEANING:

Immediately upon completion of stairwell rubber tile and tread system, clean floors and adjacent surfaces with cleaner approved by Manufacturer. Remove surplus adhesive and other soiling. Rinse thoroughly with clean, cold water.

Stripping and Waxing VCT:

After cleaning, strip to remove manufacturer's factory protectorant coat, and all stains and contaminants. Then wax and polish floors, minimum of 5 coats, with a high speed buffer, using wax recommended by School Maintenance Department. Inspect polished surfaces for defects underneath tiles, visible tile deformations and replace defective tiles and re-wax and buff as required.

EXTRA STOCK: Furnish Owner 5% quantity in unopened boxes of tile of each color and pattern installed, to be used in maintenance replacements.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Extent of painting work is shown on drawings and schedules, and as herein specified.

The work includes painting and finishing of interior and exterior exposed items and surfaces throughout project, except as otherwise indicated.

Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.

"PAINT" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

Paint all exposed surfaces, unless otherwise noted, whether or not colors are designated in "schedules", except where natural finish of material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint same as adjacent similar materials or areas. If color or finish is not designated, Architect will select these from standard light colors available for materials systems specified. Where indicated, "accent" colors are medium to deep shades, which shall require no more than one additional paint coat.

Following categories of work are not included as part of field-applied finish work, or are included in other sections of these specifications.

Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, miscellaneous metal, hollow metal work, and similar items. Also, for fabricated components such as architectural woodwork, wood casework, and shop-fabricated or factory-built mechanical and electrical equipment or accessories.

Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer finishing is specified for such items as (but not limited to) metal toilet enclosures, prefinished partition systems, acoustic materials, architectural woodwork and casework, finished mechanical and electrical equipment including light fixture, switchgear and distribution cabinets, elevator entrance frames, doors and equipment.

Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

SUBMITTALS:

Product Data: Submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use.

Samples: Submit samples for Architect's review of color and texture only. Provide a listing of material and application for each coat of each finish sample.

On 12"x12" hardboard, provide sample of each color and material, with texture to simulate actual conditions. On CMU face shell, provide sample of each color and material, with texture to simulate actual

conditions Resubmit samples as requested by Architect until acceptable sheen, color, and texture is achieved.

Wall Mockup: Paint 10'x10' section of wall with permanent lighting illumination for Architect's review and approval, prior to ordering paint materials.

Epoxy Paint Product Data: Epoxy paint manufacturer shall provide documentation that the epoxy product is tested and approved for application in such locations and for application on the surface material that is being used, and use is in compliance 2012 NC Building Code Sections 1210.2 and 1210.3; and in compliance with 2012 Plumbing code Sections 419.3 and 417.4.1 for providing smooth, hard non-absorbent surfaces adjacent to urinals and water closets and shower heads.

DELIVERY AND STORAGE:

Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:

- Name or title of material
- Fed. Spec. number, if applicable
- Manufacturer's stock number and date of manufacturer
- Manufacturer's name
- Contents by volume, for major pigment and vehicle constituents
- Thinning instructions
- Application instructions
- Color name and number

JOB CONDITIONS:

Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C), unless otherwise permitted by paint manufacturer's printed instructions.

Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F (7 degrees C) and 95 degrees F (35 degrees C), unless otherwise permitted by paint manufacturer's printed instructions.

Do not apply paint in snow, rain, fog or mist; or when relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by paint manufacturer's printed instructions.

Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

PART 2: PRODUCTS

COLORS AND FINISHES:

Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

Paint Coordination: Provide finish coats which are compatible with prime paints used. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates.

Federal Specifications establish minimum acceptable quality for paint materials. Provide written certification from paint manufacturer that materials provided meet or exceed these minimums.

Provide undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

EXTERIOR PAINT SYSTEMS:

A. METAL - (Galvanized)

1. Acrylic Systems

a. Gloss Finish

- i. Surface Preparation: Refer to Part 3 Surface Preparations of these specifications for Cleaning & Testing/Evaluations; Manufacturer's guidelines and recommendations stand as requirements of this work.
- ii. 1st Coat: S-W Pro-Cryl Universal Primer, B66-310 Series (10 mils wet, 4.0 mils dry film thickness)
- iii. 2nd Coat: S-W Sher-Cryl HPA High Performance Acrylic, B66-300 Series (10 mils wet, 4 mils dry film thickness)
- iv. 3rd Coat: S-W Sher-Cryl HPA High Performance Acrylic, B66-300 Series (10 mils wet, 4 mils dry film thickness)

B. METAL - (Misc. Iron, Ornamental Iron, Catwalks, Fire Escapes, Hydrants, Handrails, Ladders, Fences)

1. ACRYLIC Systems

a. Gloss Finish

- i. Surface Preparation: Manufacturer's guidelines and recommendations stand as requirements of this work
- ii. 1st Coat: S-W Pro-Cryl Universal Primer, B66-310 Series (10 mils wet, 4.0 mils dry film thickness)
- iii. 2nd Coat: S-W Pro Industrial Multi-Surface Acrylic, B66-500 Series
- iv. 3rd Coat: S-W Pro Industrial Multi-Surface Acrylic, B66-500 Series (4 mils wet, 2 mils dry per coat)

C. METAL - (Shop Primed Metal Doors and Frames/ Panels, etc.)

1. Acrylic Systems

- a. Gloss Finish
 - i. Surface Preparation: Manufacturer's guidelines and recommendations stand as requirements of this work
 - ii. 1st Coat: S-W Pro Industrial Multi-Surface Acrylic, B66-500 Series
 - iii. 2nd Coat: S-W Pro Industrial Multi-Surface Acrylic, B66-500 Series (4 mils wet, 2 mils dry per coat)

D. PRECAST CONCRETE UNITS (Pre-Cast Window Sills, Pre-Cast Concrete Benches, Caps, Decorative Items)

1. Acrylic Systems

- a. Low Luster Finish
 - i. 1st Coat: Euclid Increte Clear Seal Natural Sealing Compound, 150 to 350 sq. ft. per gallon
 - ii. 2nd Coat: Euclid Increte Clear Seal Natural Sealing Compound, 200 to 400 sq. ft. per gallon

INTERIOR PAINT SYSTEMS

A. MASONRY - (Walls & Ceilings, Poured Concrete, Precast Concrete, Unglazed Brick, Cement Board)

2. Acrylic Enamel Systems

- a. Semi-Gloss Finish
 - i. 1st Coat: Block filler, tinted with coats as required to fill pits and pores.
 - ii. 2nd Coat: S-W Pro-Classic Waterborne Acrylic, B31W51 Series
 - iii. 3rd Coat: S-W Pro-Classic Waterborne Acrylic, B31W51 Series (4 mils wet, 2 mils dry per coat)

B. PRECAST CONCRETE UNITS (Pre-Cast Window Sills, Pre-Cast Concrete Benches, Caps, Decorative Items)

2. Acrylic Systems

- b. Low Luster Finish
 - i. 1st Coat: Euclid Increte Clear Seal Natural Sealing Compound, 150 to 350 sq. ft. per gallon
 - ii. 2nd Coat: Euclid Increte Clear Seal Natural Sealing Compound, 200 to 400 sq. ft. per gallon

C. WET AREAS - (All Toilets and Restrooms CMU walls, Gypsum Board Walls and Ceilings, All Shower Wall and Ceilings, High Moisture Areas). NOTE: Epoxy paint manufacturer shall provide documentation that the epoxy product is tested and approved for application in such locations and for application on the surface material that is being used.

1. Epoxy Systems

a. Gloss Finish

- i. 1st Coat CMU: S-W PrepRite Block Filler, B25W25 (tinted and rolled in to fill all pits and pores completely, as required)
- ii. 1st Coat Gyp. Bd.: S-W PrepRite Classic Latex Primer, B28W101 (4 mils wet, 1.2 mils dry)
- iii. 2nd Coat: S-W Water Based Catalyzed Epoxy, B73-300 Series (8 mils wet, 4 mils dry)
- iv. 3rd Coat: S-W Water Based Catalyzed Epoxy, B73-300 Series (8 mils wet, 4 mils dry)

D. CONCRETE FLOORS – (Shop Floors, Utility Platforms, Custodial Spaces, Stairwells, Equipment Rooms, Boiler Rooms).

1. Urethane Systems

a. Gloss Finish (pigmented grey)

- i. 1st Coat: Pressure wash
- ii. 2nd Coat: S-W Armorseal Rexthane I, B65-60 Series
- iii. 3rd Coat: S-W Armorseal Rexthane I, B65-60 Series (shop floors with anti-slip additive)

E. METAL - (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous Structural Steel Members, Miscellaneous & Ornamental Iron, Sashes, Doors, Door Frames, Partitions, Cabinets, Lockers, Radiators, Wall Louvers, Pumps, Motors, Machines, Convector, Ducts [Ventilating], Electrical Raceways & Conduits, Elevator Cabs, Copper, Non-Galvanized Metal)

1. Acrylic Systems

a. Gloss Finish

- i. 1st Coat: S-W Pro-Cryl Universal Primer, B66-310 Series (10 mils wet, 4.0 mils dry film thickness)
- ii. 2nd Coat: S-W Pro Industrial Multi-Surface Acrylic, B66-500 Series
- iii. 3rd Coat: S-W Pro Industrial Multi-Surface Acrylic, B66-500 Series (4 mils wet, 2 mils dry per coat)

2. Dryfall Alkyd Systems (EXPOSED STRUCTURE WHERE SCHEDULED)

a. Gloss Finish

- i. 1st Coat: S-W Kem Bond HS Metal Primer, B50Z Series (8 mils wet, 5 mils dry)

- ii. 2nd Coat: S-W Waterborne Acrylic Dry Fall, B47W65 (8 mils wet, 4 mils dry)
- iii. 3rd Coat: S-W Waterborne Acrylic Dry Fall, B47W65 (8 mils wet, 4 mils dry)

F.METAL - (Galvanized)

1. Acrylic Systems

c. Gloss Finish

- i. Surface Preparation: Refer to Part 3 Surface Preparations of these specifications for Cleaning & Testing/Evaluations; Manufacturer's guidelines and recommendations stand as requirements of this work.
- ii. 1st Coat: Pro-Cryl Universal Primer, B66-310 Series (10 mils wet, 4.0 mils dry film thickness)
- iii. 2nd Coat: S-W Pro Industrial Multi-Surface Acrylic, B66-500 Series
- iv. 3rd Coat: S-W Pro Industrial Multi-Surface Acrylic, B66-500 Series (4 mils wet, 2 mils dry per coat)

G. WOOD - Walls, Ceilings, Doors, Trim, Cabinet Work, Counters, Partitions, Frames [Including Sitka Spruce, Southern Pine, Douglas Fir, Cedar, Redwood, Lauan])

1. Stained & Varnished (Clear Finish)

a. Open Grained Wood

- i. 1st Coat: S-W Interior Oil Stain, A48 Series
- ii. 2nd Coat: S-W Sher-Wood Natural Filler, D70T1
- iii. 3rd Coat: S-W Oil Base Varnish, Gloss A66V91
- iv. 4th Coat: S-W Oil Base Varnish, Gloss or Satin A66 Series

b. Closed Grain Wood

- i. 1st Coat: S-W Interior Oil Stain, A48 Series
- ii. 2nd Coat: S-W Oil Base Varnish, Gloss A66V91
- iii. 3rd Coat: S-W Oil Base Varnish, Gloss or Satin A66 Series (4 mils wet, 1.5 mils dry per coat)
- i.

H. NON-TEXTURED SMOOTH DRYWALL (Walls, Ceilings, Gypsum Board, Wood Pulp Board, Plaster Board, Etc.)

2. Acrylic Enamel Systems

- a. Base Coat: SHEETROCK Brand First Coat (for equalizing textures)

b. Semi-Gloss Finish (UNLESS NOTED OTHERWISE)

- v. 1st Coat: S-W PrepRite Classic Latex Primer, B28W101 (4 mils wet, 1.2 mils dry)
- vi. 2nd Coat: S-W Pro-Classic Waterborne Acrylic, B31W51 Series
- vii. 3rd Coat: S-W Pro-Classic Waterborne Acrylic, B31W51 Series (4 mils wet, 2 mils dry per coat)

I. TEXTURED DRYWALL (Walls, Ceilings, Gypsum Board, Wood Pulp Board, Plaster Board, Etc.)

3. Acrylic Enamel Systems

a. Semi-Gloss Finish

- i. 1st Coat: S-W PrepRite Classic Latex Primer, B28W101 (4 mils wet, 1.2 mils dry)
- ii. 2nd Coat: S-W Pro-Classic Waterborne Acrylic, B31W51 Series
- iii. 3rd Coat: S-W Pro-Classic Waterborne Acrylic, B31W51 Series (4 mils wet, 2 mils dry per coat)

J. CANVAS PIPE WRAP (exposed to view)

1. Latex Systems

a. Flat Finish

- i. 1st Coat: S-W PrepRite 200 Latex Primer, B28W200 (add fungicidal agent) (4 mils wet, 1.2 mils dry)
- ii. 2nd Coat: S-W ProMar 200 Latex Flat B30W200 Series (4 mils wet, 2 mils dry)
- iii. 3rd Coat: S-W ProMar 200 Latex Flat B30W200 Series (4 mils wet, 2 mils dry)

PART 3: EXECUTION

INSPECTION:

Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of manner acceptable to Applicator.

Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.

Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

SURFACE PREPARATION:

General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions, SSPC-SP, and as herein specified, for each particular substrate condition.

SSPC-SP: Steel Structures Paint Council Surface Preparation Specification No. #

Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

Wood: Clean wood surfaces to be painted. Remove dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.

Ferrous Metals: Clean ferrous surface, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.

Touch-up shop-applied primed coats wherever damaged or bare, where required by other sections of these specifications. Clean and touch-up with same type shop primer.

Galvanized Surfaces:

Hot-Dipped Galvanizing: Allow hot-dipped galvanized items to weather 6 months prior to surface preparations, and then steam clean per SSPC-SP 1. Do not use hydrocarbon solvents, vinegar or other mild acids for cleaning hot dipped galvanized surfaces. After cleaning, perform spot testing for any manufacturer's pre-treatments, using the procedure from ASTM D2092, Method B201, Volume 06.01. After pre-treatments testing, apply 2' x 2' paint test patch for evaluation of paint surface adhesion. Evaluate the adhesion at three locations of the surface area, by performing a tape adhesion test per ASTM Method D3359. Grade the tape adhesion of the coating by following ratings as set forth in ASTM D3359-97.

Galvalume: Clean free of grease, oil, dirt, soil, and other surface contaminants with hydrocarbon free solvent cleaner. Perform a light brush blasting per SSPC-SP7 if necessary. After cleaning, apply 2' x 2' paint test patch for evaluation of paint surface adhesion. Evaluate the adhesion at three locations of the surface area, by performing a tape adhesion test per ASTM Method D3359. Grade the tape adhesion of the coating by following ratings as set forth in ASTM D3359-97.

Special Food Service Area Wall Preparation: Special preparation will be required to assure that required Food Service area CMU wall surfaces are pointed and patched in strict accordance with the drawing's CMU surface preparation General Notes for on-site approval by local Health Department. All work resulting from inspection comments and requirements are to be provided at no additional cost.

Previously Coated Surfaces:

Maintenance painting will frequently not permit or require removal of old coatings prior to repainting. However, all surface contaminants such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold, mildew, efflorescence, and sealers must be removed to assure sound bonding to the tightly adhering old paint. Glossy surfaces of old paint films must be clean and dulled before repainting. Thorough washing with an abrasive cleaner will clean and dull in one operation, or wash thoroughly and dull by sanding. Spot prime any bare areas with appropriate primer. Check for compatibility by applying a test patch of the recommended coating system, covering at least 2 to 3 square feet. Allow to dry one week before testing adhesion per ASTM D3359. If the coating system is incompatible, report findings to Architect.

Existing Stained Wood:

Wood must dry and cleaned of dirt, grease, wax, polish, and marks. Old finishes in poor condition should be completely removed and the surface treated as a new surface. Sand wood to a smooth surface with 100-120 grit paper. Remove sanding dust with a vacuum or tack cloth. Avoid sanding wood that has only stain on it, sanding will remove some of the stain creating an uneven appearance. Sand down bare spots and scratches, and stain to match adjacent color. Very lightly scuff sand between finish coats, 180 grit paper or finer, removing any raised graining. Perform adhesion testing, identifying any presence of any sanding sealer, which can prevent bonding and cause peeling.

LEAD-BASED PAINT RENOVATION, REPAIR, AND PAINTING:

Applicators who perform painting renovations in housing or child occupied facilities built before 1978 must be certified by the Health Hazards Control Unit (HHCU). All work shall comply with requirements as published by the EPA Lead-Based Paint Renovation, Repair and Painting Rule in the Code of Federal Regulations.

Samples: For determining whether components are free of lead-based paint, certified applicators may collect paint chip samples and submit samples to a laboratory recognized by NLLAP for analysis. Required paint chip samples documentation shall be prepared and maintained by the certified applicator for three years.

MATERIALS PREPARATION:

Mix and prepare painting materials in accordance with manufacturer's directions.

Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

APPLICATION:

General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

Special Food Service Area Wall Application: Roll-in two coats of masonry block filler coating in Food Service areas as necessary to completely fill all pits and pores prior to application of top coats. Final finished topcoat in Food Service areas to be free of all pits and pores, with a smooth completely washable surface. Apply additional coats when final coat of paint does not uniformly fill all pits and pores. Provide all work described as necessary to obtain an on-site approval by local Health Department.

Finish exterior doors on tops, bottoms and side edges same as exterior faces, unless otherwise indicated.

Sand lightly between each succeeding enamel or varnish coat.

Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to those items exposed in occupied spaces.

Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

CLEAN-UP AND PROTECTION:

Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.

Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others by protection of their work, after completion of painting operations.

At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

EXTRA STOCK:

Furnish extra paint in manufacturer's sealed shipping containers. Provide one gallon for each type and color of paint applied in the project. Containers shall only be opened by the painter manufacturer/supplier to formulate required colors/mixes. These extra materials shall not be opened or used by the Contractor without written permission from the Owner. Place a label, protected by clear plastic on the lid of each container with the following typewritten information:

1. Paint Manufacturer
2. Product name and number
3. Mixing and color formulation
4. Painting contractor
5. Date that the paint container is put in the Owner's inventory
6. Room or area number where the paint applied was used

END OF SECTION

FINISH COLOR SCHEDULE: JCS / THANKSGIVING ELEMENTARY SCHOOL
4/1/2025

Item Needed	Manufacturer	Color Name	Color #	Comments
Throughout				
Ceiling Paint	Sherwin Williams	Ceiling White	SW-7007	
Wall Paint (Unless otherwise noted)	Sherwin Williams	Incredible White	SW-7028	
Stage Accent Paint	Sherwin Williams	Blustery Sky	SW-9140	please see diagram
Door Frames 500 WING	Sherwin Williams	Retreat	SW-6207	
Door Frames 100, 200, 300, 400, connectors	Sherwin Williams	Blustery Sky	SW-9140	
Wood Doors	Lambton	Stratford Mahogany	PLS-103	
Metal Lockers	Penco	Slate Blue		
Tackboards	Claridge	Curry	KV237	Classrooms and Halls
Markerboard				
Window Blinds	LEVOLOR	GRAYWASH	2"-362	
Misc				
Toilet Partitions	AS1	Black Texture	#9205	
Solid Surface	Corian	Matterhorn		
Media & Reception Desk Wood Trim / Bull Nose	ICI Scientific	Oak Harvest	#5000	MATCH THIS COLOR
3-Form Doors		Sandstone FOI / Banana Fiber Light		
Acoustical Panels				
Interior Signage	Mohawk	Copper	253	
Bluestone Window Sills	Buckingham Slate	GradeA		
Corridor Flooring Logo:				
MCT	Forbo	Bleekerstreet	3127	Dark Red
MCT	Forbo	Kyoto	3126	Orange
MCT	Forbo			
Flooring				
Stage Ramp VCT	FORBO Eternal Step	CLOUDY	171642	two ramps in 400 building
MCT	Forbo	Fresno Blue	MCT-3055	
MCT	Forbo	Jade	MCT-3222	
MCT	Forbo	Shitake	MCT-3233	Brown
MCT	Forbo	Rosato	MCT-3120	Light Brown
Carpet	Mohawk Faculty Remix	Regenerated Indigo	565	Blue-gray multi color
Rubber Base	Roppe	Chameleon	624	
Flooring Expansions Transitions in Corridor	MM Systems	Fog Gray		
Laminate SCHEMES				
SEE NEXT PAGE FOR ROOM LISTINGS				
SCHEME 1 - alternating rooms in 500 wing (K-1)				
Laminate	Formica	Desert Beige	899-58 matte	HORIZONTAL SURFACES
Laminate	Formica	Earthenware	8241-PG pure grain	VERTICAL SURFACES AND CUBBIES
SCHEME 2 - alternating rooms in 500 wing (K-1)				
Laminate	Formica	Desert Beige	899-58 matte	HORIZONTAL SURFACES
Laminate	Formica	Green Slate	8793-PG pure grain	VERTICAL SURFACES AND CUBBIES
SCHEME 3 - alternating rooms in 200 wing (2-3)				
Laminate	Formica	Sail White	463-PX plex	HORIZONTAL SURFACES
Laminate	Formica	Fossil	5349-PX plex	VERTICAL SURFACES AND CUBBIES
SCHEME 4 - alternating rooms in 200 wing (2-3)				
Laminate	Formica	Sail White	463-PX plex	HORIZONTAL SURFACES
Laminate	Formica	Winter Sky	8792-PX plex	VERTICAL SURFACES AND CUBBIES
SCHEME 5 - alternating rooms in 300 wing (4-5)				
Laminate	Formica	Sail White	463-PX plex	HORIZONTAL SURFACES
Laminate	Formica	Winter Sky	8792-PG pure grain	VERTICAL SURFACES AND CUBBIES
SCHEME 6 - alternating rooms in 300 wing (4-5)				

FINISH COLOR SCHEDULE: JCS / THANKSGIVING ELEMENTARY SCHOOL
4/1/2025

Item Needed	Manufacturer	Color Name	Color #	Comments
Laminate	Formica	Sail White	463-PX plex	HORIZONTAL SURFACES
Laminate	Formica	Fossil	5349-PG pure grain	VERTICAL SURFACES AND CUBBIES
SCHEME 7 - 100 wing MEDIA CENTER AREA and 400 wing				
Laminate	Formica	Sail White	463-PX plex	HORIZONTAL SURFACES
Laminate	Formica	Winter Sky	8792-PG pure grain	VERTICAL SURFACES AND CUBBIES
SCHEME 8 - 100 wing all areas except MEDIA and TEACHER WORKROOMS in 200, 300, 500 wings				
Laminate	Formica	Sail White	463-PX plex	HORIZONTAL SURFACES
Laminate	Formica	Winter Sky	8792-PG pure grain	VERTICAL SURFACES AND CUBBIES
Media Furnishings	Wood Int. Systems	Redwood on Red Oak	RCM-016	with FORMICA 463-PX Sail White Plex Finish
Wood casework trim and oak reveals		MATCH DOOR STAIN		
Item B, D, H, N P2 and P	Russwood	RCM 012 Dark Oak		on red oak
Item O	Momentum, 9to5	SISAL		Grade C
Item J				
Plastic		Latte	SC20	
Fabric	Versa Motion	Oatmeal		
Item K				
Plastic		Latte	SC20	
Fabric	Versa Motion	Oatmeal		
GG				
Back (Mesh)	Sit On It	Sand		Focus Mesh
Seat (fabric)	Sit On It	Cornerstone		Burst
Display Case Wall Covering and Corridor Display Boards	VICRTEX, Buglebeads	Ocean	BB27-71	
Ceramic Tile				
Wall Tile:	Daltile Volume 1.0	Aural Sand	VL77	
Wall Grout	Custom Building Products	Antique White	10	
Floor Tile and Accent Band	Daltile Volume 1.0	Accent Brown	VL78	
Floor Grout and Accent Grout	Custom Building Products	New Taupe	185	
Kitchen				
Serving Line	LowTemp / SpecLine	Azure Blue	RAL 5009	
Kitchen Service Carts	Cambro	Slate Blue	401	
Muilt Purpose				
Gym Floor	TaraFlex	Maple Design	6381	
Wall Paint				
Game Lines				
Border				
Basketball		White		
Main Volleyball Court		Light Blue		
Wall Pads and Volleyball Pads	Gared PSS	BEIGE	W05	
Divider Curtain	Gared PSS	BEIGE	C05	
Basketball Goal Backboard Safety Padding	Gared PSS	GOLD	PMCEGLD	
Folding Wall	Kwik-Wall	Bamboo Grove with Dark Brown Gasketing		
Exterior				
Brick	Palmetto	Brown Wirecut		
Mortar	Holcim	Santee Salmon		
Roof	Metal Roofing Systems, Inc	Medium Bronze		
Metal Trims, Gutters, Downspouts and Fascia	Metal Roofing Systems, Inc	Medium Bronze		to match the roof color.
Louvers in Brick	PTTORFF ALL-LITE	Statuary Bronze	M-18153, M-19153	
Soffit	Metal Roofing	BONE WHITE		
EIFS	PAREX	10407LALMOND		PAREX SAND FINE LB

FINISH COLOR SCHEDULE: JCS / THANKSGIVING ELEMENTARY SCHOOL
4/1/2025

Item Needed	Manufacturer	Color Name	Color #	Comments
ACM Panels	REYNOBOND	ANODIC CLEAR		
Pre Cast Sill	Southern Castings	Natural		
Mortar for Precast Window Sills		Sahara		
Canopy Sealant	Pecora Corp	Classic Bronze	46	

Laminate Scheme Schedule

SCHEME 1		
EDGE BANDING: C200181		
"WALLABY" WR D439		
Room Number		Room Description
502	A	Classroom
502	B	Cubbies
502	C	Storage
504	A	Classroom
504	B	Cubbies
504	C	Storage
505	A	Classroom
505	B	Cubbies
505	C	Storage
507	A	Classroom
507	B	Cubbies
507	C	Storage
510	A	Classroom
510	B	Cubbies
510	C	Storage
512	A	Classroom
512	B	Cubbies
512	C	Storage
515	A	Classroom
515	B	Cubbies
515	C	Storage
517	A	Classroom
517	B	Cubbies
517	C	Storage

SCHEME 2		
EDGE BANDING: C200181		
"WALLABY" WR D439		
Room Number		Room Description
501	A	Classroom
501	B	Cubbies
501	C	Storage
503	A	Classroom
503	B	Cubbies
503	C	Storage
506	A	Classroom
506	B	Cubbies
506	C	Storage
508	A	Classroom
508	B	Cubbies
508	C	Storage
509	A	Classroom
509	B	Storage
516	A	Classroom
516	B	Cubbies
516	C	Storage
518	A	Classroom
518	B	Cubbies
518	C	Storage

SCHEME 3		
EDGE BANDING: CANPLAST "SHADOW" WA D96		
Room Number		Room Description
201		Classroom
204		Classroom
205		Classroom
208		Classroom
217		Classroom
220		Classroom
221		Classroom
224		Classroom
225		Classroom

SCHEME 4		
EDGE BANDING: CANPLAST "SHADOW" WA D96		
Room Number		Room Description
202		Classroom
203		Classroom
206		Classroom
207		Classroom
212		Resource
218		Classroom
219		Classroom
222		Classroom
223		Classroom
226		Classroom

SCHEME 5		
EDGE BANDING: CANPLAST "SHADOW" WA D96		
Room Number		Room Description
301		Classroom
304		Classroom
305		Classroom
308		Classroom
317		Classroom

SCHEME 6		
EDGE BANDING: CANPLAST "SHADOW" WA D96		
Room Number		Room Description
302		Classroom
303		Classroom
306		Classroom
307		Classroom
312		Resource
318		Classroom

SCHEME 7		
EDGE BANDING: CANPLAST "SHADOW" WA D96		
Room Number		Room Description
127		Media Center
128		Office / Workroom
129		Storage
131		Resource
404	A	Music Room
404	B	Music Storage
405	A	Art Room
405	B	Art Storage
406	B	Storage
407	C	Storage
417		General Storage

SCHEME 8		
EDGE BANDING: CANPLAST "SHADOW" WA D96		
Room Number		Room Description
101		Reception
102		Administrative Assistant
104		Break Room
105		Workroom
110	A	Health
117		Attendance
120		Computer Lab
121	A	E.C. Classroom
123	A	E.C. Classroom
126	A	E.C. Classroom
210		Teacher Planning
310		Teacher Planning
513	A	Teacher Planning

PRELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

ART 1: GENERAL

DESCRIPTION OF WORK:

Extent of chalkboards, markerboards, and tackboards, marker wall units and tack wall units, is shown on drawings.

Types of chalkboards, markerboards, and tackboards, marker wall units and tack wall units, specified in this section include the following:

- Liquid Markerboards
- Vinyl Faced Natural Cork Tackboards
- Marker Wall Units, where indicated
- Tack Wall Units, where indicated

QUALITY ASSURANCE:

Manufacturer: Unless otherwise acceptable to Architect, furnish all markerboards and tackboards by one manufacturer for entire project.

Surface Burning Characteristics: Provide tackboard surfaces which are identical in composition to those with surface burning characteristics indicated below, as determined by testing in compliance with ASTM E 84. Use only tackboards which are labeled and listed by a testing and inspection agency acceptable to authorities having jurisdiction.

Flame Spread: Not more than 25

Smoke Developed: Not more than 25

SUBMITTALS:

Product Data: Submit manufacturer's technical data and installation instructions for each material and component part, including data substantiating that materials comply with requirements.

Samples: Submit full range of color samples for each type of chalkboard, tackboard, trim and accessories required. Provide 12" square samples of sheet materials and 12" lengths of trim members for color verification after selections have been made.

Shop Drawings: Submit for each type of markerboard and tackboard. Include sections of typical trim members and dimensioned elevations. Show anchors, grounds, reinforcement, accessories, and installation details.

SPECIALTY PROJECT WARRANTY:

Warranty on Porcelain Enamel Markerboards: Provide written warranty, signed by manufacturer, agreeing to replace, within the lifetime of the original installation, porcelain enamel markerboards which do not retain original writing and erasing qualities, defined to include surfaces which become slick and

shiny, or exhibit crazing, cracking, or flaking; provide manufacturer's instructions for handling, installing, protecting and maintaining markerboards have been adhered to during the warranty period. Replacement is limited to material replacement only and does not include labor for removal and reinstallation.

Warranty Period: Life of original installation

PART 2: PRODUCTS

ACCEPTABLE MANUFACTURERS:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

Manufacturers Markerboards and Tackboards, Marker Wall Units and Tack Wall Units:

- Claridge Products and Equipment
- PolyVision
- Greensteel, Inc.

MATERIALS:

Markerboards:

24 gauge porcelain enamel steel with 3.5 - 4.5 mil surface deposition, fired onto steel sheet at no less than 1500 degrees Fahrenheit. Reflectance no more than 20% and no less than 15%. Core to be 1/2" particleboard with aluminum moisture retardant backer sheet. Shall accept dry erase felt tip marker, grease pencil, ball point pens, pencils, and crayons, and can be cleaned with a damp cloth. Permanent marker may be removed with a mild solvent. Equivalent to Claridge "LCS24 Markerboard" – Color No. 32 LCS White

Vinyl Faced Tackboards:

Claridge 800 Series, Fabriccork self-healing, mildew resistant 15 oz. textured vinyl over single layer 1/4" thick, seamless compressed cork sheet, face sanded for natural finish, complying with MS MIL-C15116, laminated to 1/4" hardboard. Meets or exceeds Federal Specification CCC-408A, and ASTM E84 Class A test results. Patterns shall be selected from vinyl fabric lines: Viewpoint, Esquire, Linden, and Belair.

Marker Wall Units, where indicated:

Where indicated, provide Claridge LCS3 Porcelain Marker Walls, full and partial height dry erase marker walls. Stand alone or grouped together, or to cover an entire wall, floor-to-ceiling, up to 10 feet, in portrait orientation. Provide matched butt joints for continuous writing surface multiple piece arrangement. Refer to Drawings for locations, height and length of wall area to be covered. Provide cut outs for wall mounted devices, switches, outlets, and other considerations. Provide blocking within ground frame sill trim. Color to be selected from manufacturer's standard colors.

Tack Wall Units, where indicated:

Where indicated, provide Claridge Tack Walls, full or partial height edge-wrapped tackable panels. Stand alone or grouped together, or to cover an entire wall, floor-to-ceiling, up to 10 feet, in portrait orientation. Fabriccork self-healing, mildew resistant 15 oz. textured vinyl or fabric over single layer 1/4" thick,

seamless compressed cork sheet, laminated to 1/4" hardboard. Interior butt joints shall feature wrapped edges. Meets or exceeds Federal Specification CCC-408A, and ASTM E84 Class A test results. Patterns shall be selected from Fabriccork vinyl fabric lines: Viewpoint, Esquire, Linden, and Belair.

TRIM AND ACCESSORIES:

General: Fabricate frames and trim of not less than 0.062" thick aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units wherever possible and keep joints to minimum. Miter corners to neat, hairline closure.

Markerboard Trim: Claridge Products "Series I", 1 1/2" wide frame trim, or equivalent.

Tackboard Trim: Claridge Products, 5/8" trim, or equivalent.

Marker Wall Trim: Claridge Products perimeter mounting ground frame and trim, #1015 extruded ground head and sill, with #1016 - 1 1/16" snap-on trim. Provide aluminum spline bar at multiple piece butt joints.

Aluminum Finish: Furnish exposed aluminum trim, accessories and fasteners with the following finish:

Clear Anodized Finish: Manufacturer's standard satin anodized finish with clear anodic coating complying with AIA requirements for Class II Architectural Coating (AA-A31).

Field-Applied Trim: Provide one of the following types:

- Slip-on trim, to eliminate grounds.
- Screw-on trim, with Phillips flat-head screws.

Chalkboards and Markerboards: Furnish continuous aluminum chalk troughs for each chalkboard, unless otherwise indicated, as follows: Solid extrusion box profile, manufacturer's standard ribbed section, with cast aluminum end caps.

Map Rail: Furnish map rail at top of each unit, unless otherwise indicated, with the following accessories for each map rail:

- Display Rail: Continuous cork approximately 2" wide, integral with map rail.
- End Stops: One at each end of map rails.
- Map Hooks: 2 for each 4' of map rail or fraction thereof.
- Flag holder: One for each room furnished.

FABRICATION:

Assembly: Provide factory-assembled chalkboard, tackboard, marker wall, and tack wall units unless field-assembled units indicated.

Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.

Provide manufacturer's standard vertical joint system between abutting sections of chalkboard.

Provide mullion trim at joints between chalkboard and tackboard.

PART 3: EXECUTION

INSTALLATION:

Install units in locations and mounting heights as shown on drawings and in accordance with manufacturer's instructions, keeping perimeter lines straight, plumb, and level. Provide all grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories for complete installation.

ADJUST AND CLEAN:

Verify accessories required for each unit are properly installed.

Clean units in accordance with manufacturer's instructions, breaking in only as recommended.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall be to provide and install all building interior signs, and to provide for the purchase of building equipment as determined by the Owner. Signs and equipment shall be purchased and installed with the allowance specified in 01056 Allowances, to include tax and freight, but not to include labor or installation, except as specifically stated below. Signs and equipment shall be installed by the Contractor in accordance with manufacturer's recommendations.

Equipment Platform egress ladder signage is not part of this allowance. Construction of masonry yard sign is not a part of this allowance. Site directional and parking signs are not part of this allowance.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section, refer to Section 01068.

SUBMITTALS:

Manufacturer's Data: Submit for approval three (3) copies of folder containing complete Manufacturer's data and installation procedures for all products to be used in work of this Section.

Shop Drawings: Submit Shop Drawings in compliance with GENERAL CONDITIONS. These drawings shall be coordinated with adjacent work.

PART 2: MATERIALS

PRODUCTS:

Interior Signage (installed): Interior signage shall be solid one piece phenolic plastic materials, sand etched raised graphics, attached to walls with (4) screws each, ADA compliant. Provide Mohawk Signs Series 200A Sand Etched Format D signs or equivalent by Best Signs. Match Existing Building Signs.

Evacuation Plan Holders: Clear polycarbonate plastic, wall mounted with 2 screws.

PART 3: EXECUTION

PRODUCT HANDLING:

Working Areas: Provide suitable areas for storage of materials and equipment.

Delivery: Deliver products to site in original sealed containers or packages bearing Manufacturer's name and brand designation.

INSPECTION

Examine all surfaces to which products are scheduled to be installed. If unsatisfactory conditions exist, report to General Contractor and do not proceed with work until conditions have been satisfactorily corrected.

INSTALLATION:

Install signs in accordance with Manufacturer's printed instructions and Shop Drawings, approved by Architect. Signs to be located with leading edge 10" from pull edge of door, center 60" above floor.

All installations shall be performed by capable workmen under direction of foreman fully qualified by experience in each respective field of installation work.

Install all equipment per processed product submittals and written manufacturer's installation instructions.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Provide fire extinguisher cabinets and extinguishers as shown on drawings and specified herein. Provide cabinets for all extinguishers except as noted.

QUALITY ASSURANCE:

Manufacturers: Fire extinguisher cabinets and extinguishers of following manufacturers, which meet all requirements of these Specifications and approved equal products by other manufacturers, will be acceptable for use on this Project:

Fire Extinguisher Cabinets

- Norris Industries
- J. L. Industries
- Larsen's Mfg. Co.

Fire Extinguishers

- Amerex Fire Extinguishers

SUBMITTALS:

Shop Drawings: Submit to Architect in quadruplicate Shop Drawings for approval of all items specified herein in accordance with General Conditions.

PART 2: PRODUCTS

Fire Extinguisher cabinets shall be "Clear Vu Series" model 1536G25, semi-recessed, with full clear acrylic bubble door and SAF-T-LOK feature, Fire Rated at fire-rated walls, white powder coated steel tub, stainless steel door and trim finish, as manufactured by JL Industries or approved equal. Cabinet shall accommodate and include an Amerex 10 pound, Class ABC Multi-Purpose Dry-Chemical fire extinguisher, Model 10 lb. B456, unless otherwise noted.

Furnish 10 pound, Amerex Class ABC extinguishers with wall mount bracket in each Custodian Room.

Furnish 10 pound, Amerex Class ABC extinguishers with wall mount bracket in each Equipment Platform where indicated.

Furnish 2.5 gallon Amerex Model B262 Class K wet chemical extinguishers in cabinets in Kitchen, in model 2536G25 cabinet.

Furnish one (1) 5 pound, Amerex Model B386T Halotron extinguisher in each Computer Lab and/or each Electronics Lab.

Furnish one (1) each 10 pound, Amerex Model 330 Class BC carbon dioxide extinguishers with wall mount bracket in Electrical and Boiler/Mechanical Rooms, no cabinet.

PART 3: EXECUTION

INSTALLATION:

Install fire extinguisher cabinets in accordance with Manufacturer's written instructions, Catalog Cuts approved by Architect, and locations pre-approved by local fire official.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, apply to the work specified in this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Projectors, and flat screen video display monitor mounting brackets shall be provided under cash allowances listed in Section 01056. Provide mechanical mounting brackets designed to support the Owner's video display monitors, where indicated on Drawings and specified in this Section.

Video Display Monitors brackets (installed): Provide as indicated in the Drawings, including but not limited to: Classrooms and Resource Rooms. After final approval from Owner, purchase and install brackets with a cash allowance under Section 01056 Allowances.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section, refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers:

Projectors: Epson

Video Display Mounting Brackets Standard: For purpose of designating type and quality for work under this Section, Drawings and Specifications are based on Sanus VisionMount products manufactured by Sanus Systems (800) 359-5520. Other Manufacturers who can furnish products or systems of same materials specified and equal in all respects will also be acceptable, such as Da-Lite, and Peerless.

WARRANTY:

The mounting bracket used shall be supplied with a warranty against defects in workmanship and materials for five (5) years.

SUBMITTALS:

Manufacturer's Data: Submit five (5) copies of folder containing complete Manufacturer's data and installation procedures for all products to be used in work of this Section.

Shop Drawings: Submit Shop Drawings in compliance with GENERAL CONDITIONS. These drawings shall be coordinated with adjacent work.

PRODUCT HANDLING:

Working Areas: Provide suitable areas for storage of materials and equipment.

Delivery: Deliver products to site in original sealed containers or packages bearing Manufacturer's name and brand designation.

PART 2: PRODUCTS (final total list of equipment to be final approved by the Owner)

FLAT SCREEN VIDEO DISPLAY MONITOR MOUNTING BRACKETS: (provide under 01056 allowance)

The flat screen video display monitor wall bracket shall be Sanus Systems Premium Series Tilt-Mount Wall Mount, Model VLT5 (for 42" to 90" flat screens), or equivalent. Model shall be coordinated with the VDM video display monitors. Load capacity: 175 lbs. Tilt-mount screen adjustment capable. UL listed. Provide with security device: horizontal lock bar mechanism for padlock. Provide a universal fastener pack of all necessary screen attachment hardware, with mounting capabilities to wood studs/gypsum wallboard, concrete, CMU block, or metal studs/gypsum wallboard. Provide all necessary accessories for a complete installation and operable assembly.

The TV/Monitor wall bracket assemblies shall be of sufficient strength to support the weight of the flat screen Video Display Monitor for which is designed, with an adequate safety factor. It shall be installed with a wall attachment device capable of supporting the weight of the Video Display Monitor, the bracket itself. Confirm and coordinate bracket capabilities with the video display monitor size and weight. The video display monitor bracket shall wall mount and hold flat screen TV 1.25" from wall. Bracket shall be adjustable in both height and width to ensure proper fit. A locking mechanism shall hold TV securely in position.

Materials: Construction of the bracket shall be of heavy gauge steel with MIG welds, in scratch-resistant Satin Black powder coated finish.

PART 3: EXECUTION

INSPECTION

Examine all surfaces to which products are scheduled to be installed. If unsatisfactory conditions exist, report to General Contractor and do not proceed with work until conditions have been satisfactorily corrected.

INSTALLATION

Brackets for Video Display Monitors shall be installed where indicated on the plans. All fasteners and components for complete assembly of the bracket shall be furnished by the manufacturers.

Provide wood wall blocking for drywall wall mounted brackets. Reference Section 06100 Rough Carpentry for wall blocking requirements.

All CMU wall brackets to be through bolted through walls with plates, nuts and washers.

Install in accordance with Manufacturer's printed instructions and Shop Drawings, approved by Architect.

All installations shall be performed by capable workmen under direction of foreman fully qualified by experience in each respective field of installation work.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and Division 1 Specification sections, apply to the work specified in this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall be to provide window treatments shown on Drawings and specified in this Section.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section, refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers:

Standard: For purpose of designating type and quality for work under this Section, Drawings and Specifications are based on products manufactured by Levolor, Inc. Other Manufacturers who can furnish similar products or systems of same materials specified will also be acceptable.

SUBMITTALS:

Manufacturer's Data: Submit for approval three (3) copies of folder containing complete Manufacturer's data and installation procedures for all products to be used in work of this Section.

Shop Drawings: Submit Shop Drawings in compliance with GENERAL CONDITIONS. These drawings shall be coordinated with adjacent work.

PRODUCT HANDLING:

Working Areas: Provide suitable areas for storage of materials and equipment.

Delivery: Deliver products to site in original sealed containers or packages bearing Manufacturer's name and brand designation.

PART 2: PRODUCTS

GENERAL:

Horizontal blinds shall be Levolor Commercial Faux Wood Blinds, complete assemblies, with disengaging clutch type tilter.

Levolor, Inc.
Faux Wood Blinds
1400 Lavon Dr., McKinney, TX 75069 USA
(800) 826-8021

Slats: Color coordinated 2 inch PVC or PMMA slats, 2 inches x 2.8mm thick - Passes 500 hour UV rated & NFPA 701 Fire retardant test. Finish with manufacturer's standard colors selected by Architect from manufacturer's standard colors.

Slat Support: Braided ladders of 100% polyester yarn color compatible with slats and spacing no more than 44mm.

Headrail: Heavy-duty, high-profile steel measuring 2 inches x 2 1/4 inches with U-shaped rolled edges treated with iron phosphate to resist corrosion. Internally fit with components required for specific performance and designed for smooth, quiet trouble-free operation. Headrail finish to be standard baked-on polyester and to coordinate with slats.

Bottom rail: Color coordinated hollow trapezoid bottom rail with recessed end-caps, 50mm width x 15mm height - passes 500 hour UV rated & NFPA 701 Fire retardant test. Engineered polymer tape buttons secure the ladder and cord. Finish to be manufacturer's standard colors or stained finish to match slats.

Lifting Mechanism: Engineered polymer and galvanized steel housing cord-locks with polymer roller bearing and steel locking pin. Two-ply polyester cord filler in braided polyester jacket lift cords that meet or exceed commercial specification 1029.86. Cord connectors are ANSI Standard color coordinated breakaway safety devices passing ANSI/WCMA A100.1-2018.

Tilt Mechanism: Permanently lubricated die-cast worm and gear type tilter. Gear mechanism in fully enclosed housing with clutch action to prevent ladder tapes from over-rotation.

Tilt Control Wand: Rounded 3/8 inch diameter, constructed of PVC, color coordinated to match slats and detachable without tools. Located on either side of individual blind unit.

Mounting Hardware: Standard hinged cover end support brackets of electroplated steel with finish coat of baked on polyester enamel in color to match headrail. Intermediate support brackets for blinds over 60 inches wide.

Valance: 3 inch color coordinated contoured valance. PVC - passes 500 hour UV rated & NFPA 701 Fire retardant test.

QUANTITIES:

Provide blinds for all exterior windows, including classrooms, and interior glass in hallways, lobbies and offices.

Blinds are not required for Dining Room, entrance lobby curtainwalls, storefront entrances, connector corridors, long main corridors facing the exterior, Media Center Work Room.

PART 3: EXECUTION

INSPECTION

Examine all surfaces to which products are scheduled to be installed. If unsatisfactory conditions exist, report to General Contractor and do not proceed with work until conditions have been satisfactorily corrected.

INSTALLATION:

Install window blinds in accordance with Manufacturer's printed instructions and Shop Drawings, approved by Architect.

Install blinds with adequate clearance to permit smooth operation of the blinds. Demonstrate blinds to be in smooth, uniform, working order.

All installations shall be performed by capable workmen under direction of foreman fully qualified by experience in each respective field of installation work.

END OF SECTION

SECTION 13900 - WET PIPE SPRINKLER SYSTEMS

PART I - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, and North Carolina for Automatic Sprinkler Systems, apply to this Section.

1.2 SUMMARY

- A. This Section provides the basic information needed to design and install a Wet-Pipe Sprinkler System for the project building.

1.3 SYSTEM DESCRIPTION

- A. System to provide coverage for the entire new addition or building. See plans for areas as indicated to be sprinkled.
- B. Coordinate with Elec. Contractor for sprinkler system interface requirements with building 120V power, and fire/smoke alarm system.
- C. Provide system to NFPA 13 Light or Ordinary hazard, Group 1 occupancy or as required for the type occupancy if other than Light/Ordinary hazard. See architectural plans for occupancy and construction types.
- D. Provide Fire Department connections as indicated. See Civil – Site plans and coordinate with local Fire Official for proper FDC type (Siamese or Storz) and preferred location prior to bid.

1.4 SYSTEM PERFORMANCE AND DESIGN REQUIREMENTS

- A. Wet pipe sprinkler subcontractor is fully responsible for the design of a complete and compliant system, certified by an North Carolina Professional Engineer or registered NICET Level III Sprinkler Designer, and responsible to obtain approval from authorities having jurisdiction for the Fire Protection Systems specified. **If indicated on contract documents; the Storage tank size, pump size, and main line sizes are indicated as basis of bid only.** Subsequent to award of contract, Sprinkler contractor shall perform all necessary investigative hydraulic work and final costs / sizes of the aforementioned will be adjusted with cost credits or adds in accordance with the general and supplemental conditions of the contracts.

The Sprinkler contractor is responsible for providing the main line piping to the site contractor for installation. The Site Contractor shall install the main line piping. All parts, pieces, assemblies, and items for a complete and compliant system shall be provided.

- B. Contact local utilities for fire hydrant flow tests results, as required to prepare design for hydraulically calculated systems.
- C. Design installation to conform to NFPA 13, N.C. State Building Codes, and the latest issue of the "Requirements for Automatic Sprinkler Systems" and all subsequent Amendments to date, as published by the North Carolina Department of Insurance.

- D. Designer is responsible for reviewing information on the plans and verifying, adjusting, or correcting sizes as necessary to meet NFPA 13 requirements and flow rates at the actual pressures available from the local utility lines at no additional cost to the contract.

1.5 SPECIAL CONDITIONS

- A. Horizontal sprinkler mains and branches shall be located as high as possible above the ceiling and heads dropped down into ceiling where ceilings are indicated on architectural reflected ceiling plans..
- B. All horizontal sprinkler pipes shall be located above the finished ceiling. If the ceiling is higher than the specified mounting height then provide the required risers and offsets to locate the pipe above the ceiling.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL Fire Protection Equipment Directory and FM Approval Guide and that conform to other requirements indicated.
- B. Listing/Approval Stamp, Label, or Other Marking: On equipment, specialties, and accessories made to specified standards.
- C. Comply with requirements of authority having jurisdiction for submittals, approvals, materials, hose threads, installation, inspections and testing.
- D. Installer's Qualifications: Firms qualified to install and alter fire protection piping, equipment, specialties, and accessories, and repair and service equipment. A qualified firm is one that is experienced (minimum of 10 previous projects similar in size and scope to this Project) in such work, familiar with precautions required, and in compliance with the requirements of the authority having jurisdiction. Submit evidence of qualifications to the Architect upon request.

1.7 SUBMITTALS

- A. Submit shop drawings and product data that includes detailed pipe layout, hangers and supports, components and accessories.
- B. Submit shop drawings and hydraulic calculations to authority having jurisdiction and Architect/Engineer for approval. Submit Proof of Approval to Architect/Engineer.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturer's Operation and Maintenance Data.
- B. Include written Maintenance Data on components of system, Servicing requirements and Record Drawings.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Provide temporary inlet and outlet caps.
- B. Maintain caps in place until installation.

1.10 EXTRA STOCK

- A. Provide extra sprinkler heads under provisions of NFPA 13.
- B. Provide suitable wrenches for each head type.
- C. Provide metal storage cabinet in location designated.

PART II - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Central Sprinkler Corporation
- B. Star Sprinkler Corporation
- C. Viking Corporation

2.2 PIPING MATERIALS

- A. Buried Piping: Ductile iron, Class 50
- B. Above Ground Inside Building Piping: Steel, Schedule 10 black. Schedule 5 or thin wall threadable pipe is not acceptable.
- C. Woven mesh stainless steel flexible hose is acceptable for drops to individual sprinkler heads.

2.3 PIPING SPECIALTIES

- A. Automatic Sprinkler Valve: Flow detector with alarm circuits, pressure switch, pressure retard chamber.
- B. Alarm Gong: Electric type, see Fire Alarm plans.
- C. Fire Department Connection: Wall type; chrome plated finish; thread size to suit fire department hardware; two way threaded dust cap and chain of same material and finish, identification plate to match finish, indicating "AUTO SPKR".

2.4 SPRINKLER HEADS

- A. Suspended Ceiling Type: Standard recessed pendant type with chrome plated finish and the matching escutcheon.
- B. Exposed Area Type: Standard upright type
- C. Sidewall Type: Recessed chrome plated finish with matching escutcheon.
- D. Fusible Link: Temperature rated for specific area hazard.

PART III - EXECUTION

3.1 WATER SUPPLY CONNECTION

- A. Connect fire protection piping to water service piping of size and in location indicated on drawings.

3.2 PREPARATION

- A. Coordinate all work with other trades.
- B. Refer to Architectural Plans for ceiling heights and types.

3.3 INSTALLATION

- A. Install sprinkler piping in accordance NFPA 13.
- B. Install sprinkler piping with drains for complete system drainage.
- C. Provide hangers and supports in accordance with NFPA 13.
- D. Install specialty sprinkler fittings according to manufacturer's written instructions.
- E. Provide alarm devices for connection, by others, to fire alarm system.
- F. Locate Fire Department connection as indicated on Drawing. Provide sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of Fire Department wrench handle.
- G. Locate outside alarm gong on building wall.
- H. Place pipe runs to minimize obstruction to other work.
- I. Place piping in concealed spaces above finished ceilings.
- J. Center heads in two directions in ceiling tile and provide piping offsets as required.

3.4 SYSTEM TESTS

- A. Hydrostatically test entire System.
- B. Test shall be witnessed by authority having jurisdiction.

3.5 FIELD QUALITY CONTROL

- A. Flush, test and inspect sprinkler piping systems according to NFPA 13 Chapter "System Acceptance".
- B. Replace piping system components that do not pass test procedures specified, then re-test to demonstrate compliance. Repeat procedure until satisfactory results are obtained.

3.6 CLEANING

- A. Clean dirt and debris from sprinklers.

3.7 DEMONSTRATION

- A. Demonstrate equipment, specialties and accessories. Review Operating and Maintenance information.

END OF SECTION 13900

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

SCOPE OF WORK:

The scope of work consists of the furnishing and installing of complete plumbing (exterior and interior) and HVAC systems including miscellaneous systems. The Mechanical Contractor (hereafter referred to as "the Contractor", either Plumbing or HVAC) shall provide all supervision, labor, materials, equipment, machinery, and any and all other items necessary to complete the systems. The Contractor shall note that all items of equipment are specified in the singular; however, the Contractor shall provide and install the number of items of equipment as indicated on the drawings and as required for complete systems.

It is the intention of the Specifications and Drawings to call for finished work, tested and ready for operation.

Any apparatus, appliance, material, or work not shown on the drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered, and installed by the Contractor without additional expenses to the Owner. Minor details not usually shown or specified, but necessary for proper installation and operation, shall be included in the Contractor's estimate, the same as if herein specified or shown.

With submission of bid, the Contractor shall give written notice to the Architect of any materials or apparatus believed inadequate or unsuitable, in violation of laws, ordinances, rules, and any necessary items or work omitted. In the absence of such written notice, it is mutually agreed that the Contractor has included the cost of all required items in his proposal, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensation.

NOTICE TO BIDDERS, INSTRUCTIONS TO BIDDERS, SUPPLEMENTARY INSTRUCTIONS, GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, SPECIAL CONDITIONS, GENERAL REQUIREMENTS bound in the front of this document are included as a part of the specifications for this work.

MECHANICAL DRAWINGS AND SPECIFICATIONS:

The mechanical drawings are diagrammatic and indicate the general arrangement of fixtures, equipment, and work included in the contract. Consult the architectural, structural and electrical drawings and details for exact location and dimensions of fixtures and equipment; where same are not definitely located, obtain this information from the Architect.

The Contractor shall follow drawings in laying out work and check drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, the Architect shall be notified before proceeding with installation. If directed by the Architect, the Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

The plans and these specifications are intended to describe, imply and convey the materials and equipment as well as necessary labor, required for the installation as outlined in the paragraph entitled "Scope of Work". Any omissions from either the drawings or these specifications are unintentional, and it shall be the responsibility of this Contractor to call to the attention of the Architect or Engineer any pertinent omissions before submission of a bid. The drawings which accompany these specifications are not intended to show in complete detail every fitting which may be required; however wherever reasonable implied by the nature of

the work, any such material or equipment shall be installed by this Contractor as a part of his contract price. In no case will any extra charge be allowed unless authorized in writing by the Architect or Engineer.

The Contractor shall arrange with the General Contractor for required concrete and masonry chases, openings, and sub-bases so as not to delay progress of work. Work shall be installed sufficiently in advance of other construction to conceal piping and to permit work to be built in where required.

It shall be understood and agreed by all parties that where the words "Furnish", "Install", and / or "Provide" appear, the following definitions apply:

- Furnish - to supply or give
- Install - to place, establish or fix in position
- Provide - to furnish and install as defined above

CODES, PERMITS, AND FEES:

The Contractor shall give all necessary notices, including electric and telephone utilities, obtain all permits, and pay all government taxes, fees, and other costs, including utility connections or extensions in connection with his work file all necessary plans, prepare all documents, and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver same to the Architect before request for acceptance and final payment for the work.

The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings (in addition to contract drawing and documents) in order to comply with all applicable laws, ordinances, rules, and regulations, whether or not shown on drawings and / or specified.

Work and materials shall conform to the latest rules of the National Board of Fire Underwriter's Code and Regulations of the State Fire Marshall, and, or guarding of any moving parts, or otherwise hazardous conditions. Nothing in these specifications shall be construed to permit work not conforming to the most stringent of applicable codes.

The State Plumbing and Mechanical codes, and the mechanical requirements as established by the State and Local Fire Marshall, and rules and regulations of the local utilities serving the project are hereby made part of this specification. Should any changes be necessary in the drawings or specifications to make the work comply with these requirements, the Contractor shall notify the Architect.

VERIFICATION OF DIMENSIONS, DETAILS, EXISTING FIELD CONDITIONS:

The Contractor shall visit the premises prior to bidding, and thoroughly familiarize himself with all details of the work, working conditions, verify dimensions in the field, provide advice of any discrepancy, and submit shop drawings of any changes he proposes to make in quadruplicate for approval before starting any work. The Contractor shall install all equipment in a manner to avoid building interference. No Change Order for extra work will be considered for items that were evident during a site visit.

The locations of existing underground utilities are shown in an approximate way only and have not been independently verified by the Owner or its representative. The Contractor shall determine the exact location of all existing utilities before commencing work and agrees to be fully responsible for any and all damages which might be occasioned by the Contractor's failure to exactly locate and preserve any and all underground utilities.

ACCEPTABLE MANUFACTURERS:

Acceptable manufacturers, as specified in the Contract Documents, implies that the specified manufacturer may produce acceptable products equal in quality of materials and performance to such item specified. The

Contractor will be required to provide products meeting or exceeding the "Standard of Quality and Performance" as dictated by the product selection noted.

SHOP DRAWINGS AND EQUIPMENT SUBMITTALS:

The Contractor shall submit minimum of five (5) and maximum of seven (7) copies of the shop drawings to the Architect for approval within thirty (30) days after the award of the general contract. If such a schedule cannot be met, the Contractor may request in writing for an extension of time to the Architect. If the Contractor does not submit shop drawings in the prescribed time, the Architect has the right to select the equipment.

Shop drawings shall be submitted on all major pieces of mechanical equipment. Each item of equipment proposed shall be a standard catalog product of an established manufacturer. Certain major groups of equipment shall be provided from a singular manufacturer. The shop drawing shall give complete information on the proposed equipment. Each item of the shop drawings shall be properly labeled, indicating the intended service of the material, the job name, and the MC's name.

The shop drawings shall be neatly bound in five (5) sets and submitted to the Architect with a letter of transmittal. The letter of transmittal shall list each item submitted along with the manufacturer's name.

Approval rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are approved, said approval does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawings and specifications.

AS-BUILT DRAWINGS:

The Contractor shall maintain accurate records of all deviations in work as actually installed from work indicated on the drawings. On completion of the project, two (2) complete sets of marked-up prints shall be delivered to the Architect.

MAINTENANCE AND OPERATING MANUALS:

Upon completion, the MC shall turn over to the Architect three (3) sets of complete maintenance manuals and parts list for all mechanical equipment used on the job. Manuals shall include equipment data, manufacturer's recommended maintenance, parts list, assembly drawings, warranties, and name, address, and phone numbers of suppliers of equipment. Indicate project name on cover and binder side.

COORDINATION WITH OTHER TRADES:

Coordinate all work required under this section with work of other sections of the specifications to avoid interference. Bidders are cautioned to check their equipment against space available as indicated on drawings and shall make sure that proposed equipment can be accommodated. If interferences occur, Contractor shall bring them to attention in writing, prior to signing of contract; or, Contractor shall at his own expense provide proper materials, equipment, and labor to correct any damage due to defects in his work caused by such interference.

INSPECTION AND CERTIFICATES:

On the completion of the entire installation, the approval of the Architect and Owner shall be secured, covering the installation throughout. The Contractor shall obtain and pay for Certificate of Approval from the public authorities having jurisdiction. A final inspection certificate shall be submitted to the Architect prior to final payment. Any and all costs incurred for fees shall be paid by the Contractor.

EQUIVALENTS:

When material or equipment is mentioned by name, it shall form the basis of the Contract. When approved by the Architect in writing, other material and equipment may be used in place of those specified, but written application for such substitutions shall be made to the Architect as described in the Bidding Documents. The difference in cost of substitute material or equipment shall be given when making such request. Approval of substitute is, of course, contingent on same meeting specified requirements and being of such design and dimensions as to comply with space requirements.

WORKMANSHIP AND MATERIALS:

All workmanship shall be of the best quality, and all equipment and materials incorporated in the work under this Contract shall be new and equal to or better than the grade specified. Deviations in workmanship or materials will be corrected by the Contractor at his expense.

WARRANTY:

The Contractor shall submit upon completion of the work, a warranty by his acceptance of the contract, that all work installed will be free from defects in workmanship and materials. If, during the period of one year, or as otherwise specified from date of Certificate of Completion and acceptance of work, any such defects in workmanship, materials, or performance appear, the Contractor shall, without cost to the Owner, remedy such defects within reasonable time to be specified in notice from the Architect. In default, the Owner may have such work done and charge cost to Contractor.

CUTTING AND PATCHING:

The Mechanical Contractor (both Plumbing and HVAC) shall furnish sketches to the General Contractor showing the locations and sizes of all openings and chases, and furnish and locate all sleeves and inserts required for the installation of the mechanical work before the walls, floors, and roof are built. The Mechanical Contractor shall reimburse the General Contractor for the cost of cutting and patching, and shall be responsible for the cost of cutting and / or patching where any mechanical items were not installed or where incorrectly sized or located. The Contractor shall do all drilling required for the installation of his hangers. See also Section 01050, Cutting and Patching.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Basic methods and requirements for Division 15, MECHANICAL, applies to all sections of Division 15.
- B. Definitions:
 - 1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
 - 2. Option or optional: Contractor's choice of an alternate material or method.

1.2 RELATED WORK

- H. Section 15250, INSULATION.
- K. Section 15980, TESTING, ADJUSTING, AND BALANCING.
- L. Section 16400, SERVICE AND DISTRIBUTION.

1.3 QUALITY ASSURANCE

- A. Section 15980, TESTING, ADJUSTING, AND BALANCING.
- B. Equipment Vibration Tolerance:
 - 1. The allowable vibration tolerance shall be in accordance with 1999 ASHRAE Applications Handbook, Table 1, 46.3. Equipment specifications require factory balancing of equipment to this tolerance.
 - 2. After air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.
- C. Products Criteria:
 - 1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. See other specification sections for any exceptions.
 - 2. Equipment Service: Products shall be supported by a service organization which maintains a complete inventory of repair parts and is located reasonably close to the site.
 - 3. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
 - 4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
 - 5. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
 - 6. Asbestos products or equipment or materials containing asbestos shall not be used.
- D. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Resident Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

E. Warranty: Section 01001, GENERAL CONDITIONS.

1.4 SUBMITTALS

- A. Submit in accordance with General Provisions.
- B. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
 - 1. Submit belt drive with the driven equipment.
 - 2. Submit electric motor data and variable speed drive data with the driven equipment.
 - 3. Equipment and materials identification.
 - 4. Fire-stopping materials.
 - 5. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
 - 6. Wall, floor, and ceiling plates.
- C. Coordination Drawings; provide where required in accordance with Section 01001, GENERAL CONDITIONS, Article, SUBCONTRACTS AND WORK COORDINATION. Provide:
 - 1. Mechanical equipment rooms.
 - 2. Interstitial space.
 - 3. Hangers, inserts, supports, and bracing.
 - 4. Pipe sleeves.
 - 5. Duct or equipment penetrations of floors, walls, ceilings, or roofs.
- D. Maintenance Data and Operating Instructions:
 - 1. Maintenance and operating manuals in accordance with Section 01010, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
 - 2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.
- E. Provide copies of approved HVAC equipment submittals to the Testing, Adjusting and Balancing Subcontractor.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - FF-S-325 Shield, Expansion; Nail, Expansion; and Nail, Drive Screw
(Devices, Anchoring, Masonry)
- C. Air Conditioning and Refrigeration Institute (ARI):
 - 430-89 Central Station Air-Handling Units
- D. American National Standard Institute (ANSI):
 - B31.1-98 Power Piping
- E. Rubber Manufacturers Association (ANSI/RMA):
 - IP-20-88 Drives Using Classical V-Belts and Sheaves - Cross Sections A,
B, C, D, and E
 - IP-21-91 Drives Using Double-V (Hexagonal) Belts (AA, BB, XX, DD Cross
Sections)
 - IP-22-91 Drives Using Narrow Multiple V-Belts (3V, 5V, and 8V Cross
Sections)
- F. Air Movement and Control Association (AMCA):
 - 410-96 Recommended Safety Practices for Air Moving Devices
- G. American Society of Mechanical Engineers (ASME):
 - Boiler and Pressure Vessel Code (BPVC):

- SEC IX-98Qualifications Standard for Welding and Brazing Procedures,
Welders, Brazers, and Welding and Brazing Operators
- H. American Society for Testing and Materials (ASTM):
 - A36/A36M-97Carbon Structural Steel
 - A575-96.....Steel Bars, Carbon, Merchant Quality, M-Grades
 - E84-98Surface Burning Characteristics of Building Materials
 - E119-98.....Fire Tests of Building Construction and Materials
- I. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:
 - SP-58-93Pipe Hangers and Supports-Materials, Design and Manufacture
 - SP-69-96Pipe Hangers and Supports-Selection and Application
- J. National Association of Plumbing - Heating - Cooling Contractors (NAPHCC):
 - 1996National Standard Plumbing Code
- K. National Fire Protection Association (NFPA):
 - 90A-96.....Installation of Air Conditioning and Ventilating Systems
 - 101-97Life Safety Code

PART 2 - PRODUCTS

2.1 BELT DRIVES

- A. Type: ANSI/RMA standard V-belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.
- B. Dimensions, rating and selection standards: ANSI/RMA IP-20 and IP-21.
- C. Minimum Horsepower Rating: Motor horsepower plus recommended ANSI/RMA service factor (not less than 20 percent) in addition to the ANSI/RMA allowances for pitch diameter, center distance, and arc of contact.
- D. Maximum Speed: 5000 feet per minute.
- E. Adjustment Provisions: For alignment and ANSI/RMA standard allowances for installation and take-up.
- F. Drives may utilize a single V-Belt (any cross section) when it is the manufacturer's standard.
- F. Multiple Belts: Matched to ANSI/RMA specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.
- H. Sheaves and Pulleys:
 - 1. Material: Pressed steel, or close grained cast iron.
 - 2. Bore: Fixed or bushing type for securing to shaft with keys.
 - 3. Balanced: Statically and dynamically.
 - 4. Groove spacing for driving and driven pulleys shall be the same.
- I. Drive Types, Based on ARI 435:
 - 1. Provide adjustable-pitch or fixed-pitch drive as follows:
 - a. Fan speeds up to 1800 RPM: 7.5 horsepower (10 kW) and smaller.
 - b. Fan speeds over 1800 RPM: 2.2 horsepower (3 kW) and smaller.
 - 2. Provide fixed-pitch drives for drives larger than those listed above.
 - 3. The final fan speeds required to just meet the system CFM and pressure requirements, without throttling, shall be determined by adjustment of a temporary adjustable-pitch motor sheave or by fan law calculation if a fixed-pitch drive is used initially.

2.2 DRIVE GUARDS

- A. For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor. Drive

guards may be excluded where motors and drives are inside factory fabricated air handling unit casings.

- B. Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.
- C. Access for Speed Measurement: 1" diameter hole at each shaft center.

2.3 ELECTRIC MOTORS

- A. Section 15170, MOTORS, specifies the applicable requirements for electric motors. Provide special energy efficient motors as scheduled. Unless otherwise specified for a particular application use electric motors with the following requirements.
- B. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC).
- C. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. Provide a time-delay (20 seconds minimum) relay for switching from high to low speed.
- D. Rating: Continuous duty at 100 percent capacity in an ambient temperature of 104 degrees F; minimum horsepower as shown on drawings; maximum horsepower in normal operation not to exceed nameplate rating without service factor.
- E. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

2.4 VARIABLE SPEED MOTOR CONTROLLERS

- A. Removed

2.5 EQUIPMENT AND MATERIALS IDENTIFICATION

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals.
- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 3/16" high of brass with black-filled letters, or rigid black plastic with white letters permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.
- C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 3/16" high riveted or bolted to the equipment.
- D. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.

2.6 FIRESTOPPING

See Sheet FP – 001. FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping and ductwork. Refer also to Section 15250, INSULATION, for firestop pipe and duct insulation.

2.7 GALVANIZED REPAIR COMPOUND

Mil. Spec. DOD-P-21035B, paint form.

2.8 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

- A. Vibration Isolators: see drawing details.

- B. Supports For Roof Mounted Items:
 - 1. Equipment: Equipment rails shall be galvanized steel, 8 gauge, with integral baseplate, continuous welded corner seams, factory installed 2 by 4 treated wood nailer, 18 gauge galvanized steel counter flashing cap with screws, built-in cant strip, (except for gypsum or tectum deck), minimum height 11 inches. For surface insulated roof deck, provide raised cant strip to start at the upper surface of the insulation.
 - 2. Pipe/duct pedestals: Provide a galvanized unistrut channel welded to U-shaped mounting brackets which are secured to side of rail with galvanized lag bolts.
- D. For Attachment to Concrete Construction:
 - 1. Concrete insert: Type 18, MSS SP-58.
 - 2. Self-drilling expansion shields and machine bolt expansion anchors: Fed. Spec. FF-S-325, permitted in concrete not less than four inches thick. Applied load shall not exceed one-fourth the proof test load listed in Fed. Spec. FF-S-325.
 - 3. Power-driven fasteners: Permitted in existing concrete or masonry not less than four inches thick when approved by the Resident Engineer for each job condition. Applied load shall not exceed one-fourth the proof test load listed in Fed. Spec. FF-S-325.
- F. For Attachment to Steel Construction: MSS SP-58.
 - 1. Welded attachment: Type 22.
 - 2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 7/8-inch outside diameter.
- F. Attachment to Metal Pan or Deck: As required for materials specified in Division 5.
- G. For Attachment to Wood Construction: Wood screws or lag bolts.
- H. Hanger Rods: See Section 15060.
- J. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 1-5/8 inches by 1-5/8 inches, No. 12 gauge, designed to accept special spring held, hardened steel nuts. Not permitted for steam supply and condensate piping.
 - 1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
 - 2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13mm (1/2-inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.
- K. Pipe Hangers and Supports:
 - 1. Convertor and Expansion Tank Hangers: May be Type 1 sized for the shell diameter. Insulation where required will cover the hangers.
 - 2. Plumbing Piping (Other Than General Types):
 - a. Horizontal piping: Type 1, 5, 7, 9, and 10.
 - b. Chrome plated piping: Chrome plated supports.
 - c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.
 - d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gage) minimum.
- L. Pre-insulated Calcium Silicate Shields:
 - 1. Provide 360 degree water resistant high density 965 kPa (140 psi) compressive strength calcium silicate shields encased in galvanized metal.
 - 2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
 - 3. Shield thickness shall match the pipe insulation.
 - 4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.

- a. Shields for supporting chilled or cold water shall have insulation that extends a minimum of 1 inch past the sheet metal. Provide for an adequate vapor barrier in chilled lines.
 - b. The pre-insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS-SP 69. To support the load, the shields may have one or more of the following features: structural inserts 4138 kPa (600 psi) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.
 5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.
- M. Seismic Restraint of Piping:
1. Design criteria is as follows:
 - a. Piping resiliently supported: 120 percent of the weight of the systems and components and contents.
 - b. Piping not resiliently supported: 60 percent of the weight of the system components and contents.
 - c. Except as noted above, meet the more severe requirements of the Local Code and the latest Uniform Building Code for determining seismic force F_p .
 2. Provide one of the following options:
 - a. Design and installation to meet the criteria listed above, and meet requirements of the latest Sheet Metal and Air Conditioning Contractors National Association (SMACNA), Seismic Restraint Manual Guidelines for Mechanical Systems for the prescribed Seismic Hazard Level
 - b. Design and installation to meet the criteria listed above, and meet the most current requirements of the National Uniform Seismic Installation Guidelines (NUSIG). Contractor shall submit all design tables and information for the design force levels, stamped and signed by a professional engineer registered in the State where project is located.
 - c. Where SMACNA or NUSIG requirements are not met completely, submit proposed alternate details and calculations to completely address seismic bracing requirements. Such designs shall use more severe of the Local Code and the Uniform Building Code requirements for determining seismic forces, and be performed, stamped and signed by a professional engineer registered in the State where project is located. Revise if necessary any details shown on the contract drawings for vertical support and lateral bracing, and submit for the approval of the Owner to meet the design criteria listed above.

2.9 PIPE PENETRATIONS

- A. Install sleeves during construction for other than blocked out floor openings for risers in chases.
- B. To prevent accidental liquid spills from passing to a lower level, provide the following:
 1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.
 2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
 3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from this requirements must receive prior approval of Resident Engineer.
- D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
- F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms and similar. Except in mechanical rooms, connect sleeve with floor plate.
- G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.
- H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.

- I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.
- J. Sealant and Adhesives: Shall be as specified in Section 07920, SEALANTS AND CAULKING.

2.10 TOOLS AND LUBRICANTS

- A. Furnish, and turn over to the Owner special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Owner.
- D. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.11 WALL, FLOOR AND CEILING PLATES

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- B. Protection and Cleaning:
 - 1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Owner. Damaged or defective items in the opinion of the Owner, shall be replaced.
 - 2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- C. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03300, CAST-IN-PLACE CONCRETE.
- D. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- E. Install steam piping expansion joints as per manufacturer's recommendations.
- F. Work in Existing Building:
 - 1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01010, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).

2. As specified in Section 01010, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.
3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Owner. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the Owner for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After Owner's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.
- G. Exterior: Seal all pipe and duct penetrations with silicone sealant to prevent entrance of insects.
- H. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.
- I. Inaccessible Equipment:
 1. Where the Engineer / Owner determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Owner.
 2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 PIPE AND EQUIPMENT SUPPORTS

- A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the Owner.
- B. Use of chain, wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above will not be permitted. Replace or thoroughly clean rusty products and paint with zinc primer.
- C. Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work.
- D. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP-69. Provide additional supports at valves, strainers, in-line pumps and other heavy components. Provide a support within one foot of each elbow.
- E. HVAC Vertical Pipe Supports:
 1. Up to 150 mm (6-inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.
 2. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.
- F. Plumbing horizontal and vertical pipe supports, refer to the State Plumbing Code.

3.3 MOTOR AND DRIVE ALIGNMENT

- A. Belt Drive: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.
- B. Direct-connect Drive: Securely mount motor in accurate alignment so that shafts are free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

3.4 LUBRICATION

Field check and lubricate equipment requiring lubrication prior to initial operation.

3.5 STARTUP AND TEMPORARY OPERATION

Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation. Temporary use of equipment is specified in Section 01010, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.6 OPERATING AND PERFORMANCE TESTS

- A. Prior to the final inspection, perform required tests as specified in Section 01010, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the Owner.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Owner.
- C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART I: GENERAL

- A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Submittals: Provide Product Data for each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

PART II: PRODUCTS

- A. Pipe Hangers, Supports, and Components: MSS SP-58, factory fabricated components.
 - 1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
 - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
 - 1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
 - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- C. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive strength insulation, encased in sheet metal shield.
 - 1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellant-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
 - 2. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
 - 3. For Clevis or Band Hanger Insert and shield cover lower 180 degrees of pipe.
 - 4. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.
- D. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- E. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
- F. Grout ASTM C 1107, Grade B, factory-mixed and -packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.
 - 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 - 2. Properties: Non-staining, non-corrosive, and non-gaseous.

PART III: EXECUTION

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.

- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
 - 2. -Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN20 to DN600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
 - 3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
 - 4. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30 (DN15 to DN750).
- D. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Steel Tumbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- E. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
 - 2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - 5. C-Clamps (MSS Type 23): For structural shapes.
 - 6. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb. (340 kg).
 - b. Medium (MSS Type 32): 1500 lb. (675 kg).
 - c. Heavy (MSS Type 33): 3000 lb. (1 350 kg).
 - 7. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 - 8. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- F. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
- G. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

1. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- L. Insulated Piping: Comply with the following:
 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9.
 2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 5. Insert Material: Length at least as long as protective shield.
 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
- M. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations. Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.
- N. Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- O. Touching Up: 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. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- P. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.
- Q. Install all hangers and supports prior to application of fire-proofing by GC. Any fire-proofing damaged by this Contractor shall be repaired by this Contractor.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART I: GENERAL

A. Submittals: Submit Product Data for each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

PART II: PRODUCTS

A. Pressure and Temperature Ratings: As required to suit system pressures and temperatures.

B. Sizes: Same size as upstream pipe, unless otherwise indicated.

C. Operators: Use specified operators and handwheels, except provide the following special operator features:

1. Handwheels: For valves other than quarter turn.
2. Lever Handles: For quarter-turn valves 6 inches (DN 1 50) and smaller, except for plug valves, which shall have square heads. Furnish Owner with 1 wrench for every 1 0 plug valves.

D. Threads: ASME B1.20.1.

E. Flanges: ASME B16.1 for cast iron, ASME B16.5 for steel, and ASME B16.24 for bronze valves.

F. Solder Joint: ASME B16.18. Where soldered end connections are used, use solder having a melting point below 840 deg F (450 deg C) for gate, globe, and check valves; below 421 deg F (216 deg C) for ball valves.

G. Gate Valves, 2-1/2 Inches (DN65) and Smaller: MSS SP-80; Class 125, 200-psi (1380-kPa) cold working pressure (CWP), or Class 150, 300-psi (2070-kPa) CWP; ASTM B 62 cast-bronze body and bonnet, solid-bronze wedge, copper-silicon alloy rising stem, teflon-impregnated packing with bronze packing nut, threaded or soldered end connections; and with aluminum or malleable-iron handwheel.

H. Ball Valves, 4 Inches (DN 1 00) and Smaller: MSS SP-1 1 0, Class 150, 600-psi (4140-kPa) CWP, ASTM B 584 bronze body and bonnet, 2-piece construction; chrome-plated brass ball, standard port for 1/2-inch (DN15) valves and smaller and conventional port for 3/4-inch (DN20) valves and larger; blowout proof; bronze or brass stem; teflon seats and seals; threaded or soldered end connections:

1. Operator: Vinyl-covered steel lever handle with hole for valve tag chains.
2. Stem Extension: For valves installed in insulated piping.
3. Memory Stop: For operator handles.

I. Globe Valves, 2-1/2 Inches (DN65) and Smaller: MSS SP-80; Class **125**, 200-psi (1 380-kPa) CWP, or Class 150, 300-psi (2070-kPa) CWP; ASTM B 62 cast-bronze body and screwed bonnet, rubber, bronze, or teflon disc, silicon bronze-alloy stem, teflon-impregnated packing with bronze nut, threaded or soldered end connections; and with aluminum or malleable-iron handwheel.

J. Globe Valves, 3 Inches (DN80) and Larger: MSS SP-85, Class 125, 200psi (1 380-kPa) CWP, ASTM A 126 cast-iron body and bolted bonnet with bronze fittings, renewable bronze seat and disc, brass-alloy stem, outside screw and yoke, teflon-impregnated packing with cast-iron follower, flanged end connections; and with cast-iron handwheel.

PART III: EXECUTION

- A. Install valves as indicated, according to manufacturers written instructions.
- B. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.
- C. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.
- D. Locate valves for easy access and provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above the center of the pipe.
- F. Install valves in a position to allow full stem movement.
- G. Installation of Check Valves: Install for proper direction of flow. Install in a horizontal position with hinge pin level.
- H. Select valves with the following ends or types of pipe/tube connections:
 - 1. Copper Tube Size, 2-1/2 Inches (DN65) and Smaller Solder ends, except provide threaded ends for heating hot water and low-pressure steam service.
- I. General Application: Use gate, ball, and butterfly valves for shutoff duty; globe, ball, and butterfly for throttling duty. Refer to piping system Specification Sections for specific valve applications and arrangements.
- J. Domestic Water Systems Applications: Use the following valve types:
 - 1. Gate Valves: Class 125, bronze or cast-iron body to suit piping system.
 - 2. Ball Valves: Class 150, 600-psi (4140-kPa) CWP, with stem extension.
 - 3. Plug Valves: Neoprene-faced plug, Buna N packing.
 - 4. Globe Valves: Class 125, bronze or cast-iron body to suit piping system, and bronze or teflon disc.
 - 5. Butterfly Valves: Nickel-plated ductile iron, aluminum bronze, or elastomer-coated ductile iron disc; EPDM or Buna N sleeve and stem seals.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

EXCAVATING AND BACKFILLING FOR MECHANICAL WORK:

Refer to specification sections 02210 - *Trenching and Backfilling for Utilities* and 02220 - *Earthwork*

In general, DO NOT excavate for mechanical work until work is ready to proceed without delay to maintain minimum time lapse from excavation to completion of backfilling. Excavate with vertical sided excavations to greatest extent possible providing sheeting and cross-bracing to sustain sides where necessary. All shoring and sheeting required to protect the excavation shall be constructed and maintained in strict accordance with all applicable State and Federal Regulations.

Excavate trench for piping to uniform width with 18" minimum clearance both sides of piping providing adequate working room. Correct over-excavation by means of backfilling with concrete, or tamped and compacted backfill material approved for other backfilling work. All excavated materials not suitable or required for backfill shall be removed as directed or required in a lawful manner.

Whenever wet or otherwise unstable soil that is incapable of adequately supporting pipe is encountered in trench bottoms, remove such material to depth required and replace to the proper grade with selected material compacted as hereinafter specified for backfilling of pipe. Provide unit prices on Form of Proposal.

Support pipe directly on undisturbed soil. Do not excavate beyond required or indicated depth, and hand-excavate bottom cut to accurate elevations. Do not backfill until installed mechanical work has been tested and accepted. Provide 6" wide utility warning tape with magnetic detection 6 to 8" below finish grade during backfill operation over all piping exterior to building.

Conditions backfill material by either drying or adding water uniformly, necessary to facilitate compaction to required densities. Do not backfill with frozen soil materials. Backfill simultaneously on opposite sides of mechanical work and compact simultaneously without dislocating work from installed positions. Continue backfilling in 8" layers, uniformly compacted to 85% density for cohesive soils, 90% for cohesionless soils (90% for cohesive, 95% for cohesionless soils under paved surfaces) using power-driven hand-operated compaction equipment. Correct improperly backfill that has settled.

All paving and concrete removed or cut, shall be replaced or patched to satisfaction of Architect.

All landscaping (trees, shrubbery, grass, etc.) removed or damaged, shall be replaced to satisfaction of Architect.

Existing utility lines (gas, electric, communications, sewer, water, etc.) shall be protected from damage during excavation and backfilling, and, if damaged, shall be repaired by the Contractor at his expense. In the event that the Contractor damages any existing utility lines, he shall report thereof immediately. If it is determined that repairs shall be made by the Contractor, such repairs shall be ordered under terms of other sections of these specifications.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART I - GENERAL

SCOPE:

This Section includes basic requirements for motors. It includes motors that are factory-installed as part of equipment and appliances as well as field-installed motors.

QUALITY ASSURANCE:

1. Comply with NFPA 70, "National Electrical Code.
2. Comply with NEMA MG-1, "Motors and Generators".
3. Comply with UL 1004, "Motors, Electric".
4. Comply with NCSBC, Volume X, Chapter 4, Section 401.2, "Electric Motors".

PART II - PRODUCTS

A. MOTORS, GENERAL

1. General: Requirements below apply to motors covered by this Section except as otherwise indicated.
2. Motors 1 hp and larger: Polyphase.
3. Motors Smaller Than $\frac{3}{4}$ " hp and less: Single-phase.
4. Frequency Rating: 60 Hz.
5. Voltage Rating: Determined by voltage of circuit to which motor is connected for the following motor voltage ratings (utilization voltages):
 - a. 120V Circuit: 115V - motor rating.
 - b. 208V Circuit: 200V - motor rating.
 - c. 480V Circuit: 460V - motor rating.
6. Service factors indicated for motors are minimum values and apply at frequency and utilization voltage at which motor is connected. Provide motors which will not operate in service factor range when supply voltage is within 10 percent of motor voltage rating.
7. Capacity: Sufficient to start and operate connected loads at designated speeds in indicated environment, and with indicated operating sequence, without exceeding nameplate ratings. Provide motors rated for continuous duty at 100 percent of rated capacity.
8. Temperature Rise: Based on 40 deg C ambient except as otherwise indicated.
9. Enclosure: Open dripproof.
10. Minimum full-load efficiency per tables 401.2.1 a & b of NCSBC Volume X Energy Code.

B. POLYPHASE MOTORS

1. General: Squirrel-cage induction-type conforming to the following requirements except as otherwise indicated.

2. NEMA Design Letter Designation: "b".
3. Internal Thermal Overload protection For Motors: For motors so indicated, protection automatically opens control circuit arranged for external connection. Protection operates when winding temperature exceeds safe value calibrated to the temperature rating of the motor insulation.
4. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading of the application.
5. Rugged Duty Motors: Totally enclosed with 1.25 minimum service factor. Provide motors with regreasable bearings and equipped with capped relief vents. Insulate windings with nonhygroscopic material. External finish shall be chemical resistant paint over corrosion resistant primer. Provide integral condensate drains.

C. SINGLE-PHASE MOTORS

1. General: Conform to the following requirements except as otherwise indicated.
2. Energy Efficient Motors: One of the following types as selected to suit the starting torque and other requirements of the specific motor application.
 - a. Permanent Split Capacitor.
 - b. Split-Phase Start, Capacitor-Run.
 - c. Capacitor-Start, Capacitor-Run.
3. Shaded-Pole Motors: Use only for motors smaller than 1/20 hp.
4. Internal Thermal Overload Protection for Motors: For motors so indicated, protection automatically opens the power supply circuit to the motor, or a control circuit arranged for external connection. Protection operates when winding temperature exceeds a safe value calibrated to the temperature returns to normal range except as otherwise indicated.
5. Bearings, belt connected motors and other motors with high radial forces on motor shaft shall be ball bearing type. Sealed, prelubricated sleeve bearings may be used for other single phase motors.

PART III - EXECUTION

INSTALLATION:

Install motors in accordance with manufacturer's published instruction.

PART IV - COMMISSIONING

1. Check operating motors, both factory and field-installed, for unusual conditions during normal operation. Coordinate with the commissioning of the equipment for which the motor is a part.
2. Report unusual conditions.
3. Correct deficiencies of field-installed units.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1 - GENERAL

DESCRIPTION OF WORK:

This section contains the requirements relating to the materials and methods used to identify items described in Division 15.

PART 2 - PRODUCTS

ENGRAVED PLASTIC-LAMINATE SIGNS:

Provide engraving stock melamine plastic laminate, in the sizes and thickness indicated, engraved with engraver's standard letter style of the sizes and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate. Plastic laminate thickness shall be 1/16" for units up to 20 square inches or 8" length; 1/8" for larger units. Provide self-tapping stainless steel screws.

PART 3 - EXECUTION

INSTALLATION REQUIREMENTS:

A. COORDINATION:

Coordinate new labeling with existing labeling through Project Manager. Where identification is to be applied to surfaces that require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, identification shall be installed after completion of covering and painting. Identification is to be installed prior to installation of acoustical ceilings and similar removable concealment.

B. DUCTWORK IDENTIFICATION:

1. General: Provide for identification of air supply, return, exhaust, intake, and relief ductwork with stenciled signs and arrows, showing ductwork service and direction of flow, in black and white.
2. Locations: Ductwork shall be identified every 20' in spaces with removable ceilings and at each access door in spaces with hard ceilings. Exposed ductwork shall be identified every 20' in mechanical rooms. As described above, ductwork shall be labeled on both sides of floor and wall penetrations.

C. MECHANICAL EQUIPMENT IDENTIFICATION:

Provide for engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices.
2. Air conditioning indoor and outdoor units.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

GENERAL:

Furnish and install complete building potable water supply system from connection provided by Sitework Contractor unless indicated otherwise on the drawings. Include utility tap fee allowance specified Section 01056-1 in bid.

WATER SERVICE PIPING:

Water service piping 4" and larger from utility main tap to point designated on drawings outside building shall be AWWA Standard C-900 PVC. The pipe joints shall be integral bell type with elastomeric gaskets. The pipe shall be pressure rated for 150 psi with dimension ratio of 18 between wall thickness and bell. Pipe shall be supplied in 20 ft. lengths.

Water service piping 3" and less outside building shall be IPS rated SDR 21 PVC water pipe conforming to material requirements of ASTM D-2241 in accordance with ASTM D-1781.

BUILDING WATER SUPPLY PIPING AND FITTINGS:

BELOW GRADE:

Building water main buried in earth and/or under concrete slab, where indicated on the plans, shall be seamless type K soft annealed copper tubing, ASTM B-88, with wrought copper ASA B-16.22 fittings and silver type solder brazed joints.

Unless indicated otherwise in the drawings, contractor is responsible for water meter and utility tap fees. Coordinate building ground to copper pipe with Electrical Contractor as required. Refer to Section 15150 for excavating and backfilling.

ABOVE GRADE:

Water piping above ground shall be seamless type L hard drawn copper tubing, ASTM B-88, with wrought copper ASA B-16.22 fittings, and 95/5 soldered joints (lead-free solder).

EXPOSED WATER PIPING:

All exposed water piping to plumbing fixtures, especially in Kitchen areas, shall be IPS chrome-plated yellow brass pipe with polished chrome-plated 125-pound screwed brass fittings, except piping noted to be run exposed in mechanical or utility areas. Any joints leaking shall be reconstructed with new materials. Flexible pipe or hose is not acceptable for final connection to any fixture on this project.

PIPING INSTALLATION:

Water piping in building and above grade shall be accurately cut to measurements established at the site, worked into place without springing or forcing, and shall satisfactorily clear all window, door, and other openings and obstructions. Excessive cutting or other weakening of the structure to facilitate piping installation will not be permitted. Sleeves shall be provided for pipe penetrating floors, walls, and roofs. Access doors and panels shall be provided as specified.

Piping shall generally run level with all changes in direction made with fittings. Branch connections shall be made with fittings. Branch lines may be taken off top of main, bottom of main, or side of main using such

crossover fittings as may be required by structural or installation conditions. All service pipe, valves, and fittings shall be kept a sufficient distance from other work to permit finished covering not less than 1/2" from such other work and not less than 1/2" between finished covering on the different service.

No water piping shall be buried in floors unless specifically indicated on drawings or approved; when buried, pipe shall be corrosion and mechanically protected. Eccentric reducers with top level shall be provided where changes in size are made.

Soldered joints shall be made up with 95-5 (tin-antimony) solder (for piping 1-1/2" and less; joints for tubing larger than 1-1/2" shall be silver brazed with "Sil-fos," "Easyflo" or "Phos-copper"). Surfaces to be joined shall be thoroughly cleaned with steel wool and paste type flux shall be applied evenly to fitting and tube. Tubing shall be inserted to shoulder in fitting and heat applied evenly to fitting until solder starts to flow into socket by capillary action. Excess solder starts to flow into socket by capillary action. Excess solder shall be wiped off before joint cools. All joints between dissimilar materials shall be provided with insulated fittings. All piping showing leaks on test shall be taken down and the joints shall be remade.

Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges having metal parts separated to prevent current flow between dissimilar metals.

Piping shall have burrs removed and shall be rattled and cleaned of loose dirt and scale before erection. Open ends of piping and equipment connections shall be plugged or capped during erection. Temporary strainers shall be provided in systems and removed after flushing operation is performed. Low points of the systems shall be provided with hose end adapters for draining systems.

The Plumbing Contractor shall have a journeyman present at all times while General Contractor is either pouring concrete or constructing masonry walls to insure proper installation of work in this Contract.

VALVES:

Valves shall be provided at risers and main branches at point of takeoff from their supply or return mains, at inlets and outlets of individual equipment units, and where indicated and/or specified. Valves shall not be installed with stem below the horizontal. Install shut-off valves on all hot and cold water branches serving more than one fixture.

Ball valves shall be used in piping up through 2". Acceptable ball valve manufacturers are Apollo (No. 70-200), Watts (No. B-6001), Nibco (No. S580), and Grinnell. Ball valves shall have brass or bronze body and ball, lever handle, teflon seats and seal, and rated up to 200 psig at 250°F.

Gate or Butterfly valves shall be used in piping 2-1/2" and larger. Acceptable valve manufacturers are Grinnell, Jenkins and Hammond. Gate valves submitted for approval shall comply with MSS Standard SP-80 for bronze valves.

UNIONS:

Unions shall be bronze 150 lb. type for copper pipe applications manufactured by Mueller, Crane, Northern Indiana Brass, or approved equivalent. Unions shall be installed at each valve and at frequent intervals in each main run of pipe to facilitate removal and repair of pipe, fixtures and appurtenances.

WATER HAMMER ARRESTORS:

The flow velocity of the water distribution system shall be controlled to reduce the possibility of water hammer. A water hammer arrestor shall be installed where quick-closing valves are utilized and where indicated on the drawings. The arrestor shall be located within an effective range of the quick-closing valve. Water hammer arrestors shall conform to AWWA, ASME A112.26.1 or ASSE 1010 listed in chapter 19. Access shall be provided to water hammer arrestors. Approved manufacturers are Watts, Smith, and Zurn.

PIPE SLEEVES:

Install pipe sleeves and properly secure in place at all points where pipes pass through floors, walls, or ceilings. Pipe sleeves shall be of sufficient diameter to provide approximately 1/4 inch clearance around insulation. Pipe sleeves in walls, floors, and partitions shall be Schedule 40 black steel. Caulk annular space between pipes and insulation and sleeves, both sides, with an elastic fire-resistant compound.

PIPE HANGERS AND SUPPORTS (see also Section 15060):

Pipe hangers and supports shall be of a size to support water filled piping with a safety factor of 5 based on hanger or support ultimate tensile strength. Hangers and supports shall be manufactured by PHD, Grinnell, B-Line Systems, or Pipe Shields, Inc. Size hangers for all insulated piping to fit over insulation with an acceptable clearance.

Hangers for hot water piping shall be equal to Grinnell Fig. 181. Vertical pipes shall be supported by wall brackets equal to Grinnell Fig. 261. Piping hanger and support installation shall allow for uniform expansion and contraction at all times. Provide 8" long 16 gauge sheet metal saddles extending 120° around bottom of insulated pipe.

PIPE INSULATION:

Insulate all hot and cold water piping. Insulation shall be a jacketed glass fiber pipe covering, 1" thick for pipe sizes 2" & less, 1½" thick for pipes 2½" & above, with flame resistant vapor barrier jacket meeting ASTM E84 and UL 723. Insulation shall be Knauf 850 or equal by Owens-Corning or Schuller. Provide PVC pre-formed jacket covers over insulated fittings such as elbows, tees, valves, etc. and over all domestic water piping in boiler room.

INSULATION INSTALLATION:

Install insulation per manufacturer's recommendations. All insulation shall be installed in a workmanlike manner by qualified workers in the regular employ of the Contractor.

All insulation shall be applied to clean, dry surfaces butting all sections firmly together and finishing as specified hereinafter. All vapor barriers shall be sealed, and shall be continuous throughout. No staples shall be used on any vapor barrier jacket. All vapor barriers shall be of the fire retardant type.

Insulation of all insulated lines shall be interpreted as including all pipe, valves, fittings, and specialties comprising the lines, except flanged unions and screwed unions on hot piping. Insulation over fittings shall be of equal thickness as the adjoining pipe insulation. Unless otherwise specified or directed, insulation for fittings and flanges shall be of the permanent type.

Support of pipe shall be on the outside of the insulation. The insulation at each support shall be rigid and of an equal thickness and finish as the adjoining pipe insulation; the length to coincide with the saddles.

CLEANING:

All surfaces on metal, pipe, insulation covered surfaces, and other equipment furnished and installed under this section of the specifications shall be thoroughly cleaned of grease, scale, dirt and other foreign materials, and new equipment shall have a coat of first-class primer.

CHLORINATION:

Before Owner occupies building, all water piping installed under this section including shall be sterilized with chlorine. This shall be accomplished by the introduction of a chlorinating material into the lines in such

quantity that the water in the lines shall contain not less than 50 parts per million of available chlorine. The chlorinating material shall be either liquid chlorine or sodium hypochlorite solution, and shall be introduced into the system in an approved manner. The sterilizing solution shall be allowed to remain in the system for a period of two hours during which time all valves and faucets shall be opened and closed several times. After sterilization, solution shall be flushed from the system with clear water until no residual chlorine remains, after which a sample shall be collected for bacterial analysis.

The entire sterilization procedure shall be in strict accordance with the requirements of the State Board of Health and, upon completion of the sterilization, the potability of the water in the system shall be checked and approved by the County Health Department.

Prior to final Payment Application, provide Engineer two copies of the Bacteriological Analysis Report for water samples taken at source and at a general tap and tested for coliform and chlorine residuals.

PRESSURE TESTING:

Test all piping and connections installed under this contract. Do testing prior to painting, backfilling, insulating or concealment within building construction. Trenches may be backfilled prior to pressure tests, but not before work has been visually inspected by the Owner. If pressure tests indicate leaks in piping, it shall be the Contractor's responsibility to determine location of leaks, excavate as required, repair leaks, and backfill at his expense.

Perform each test as specified hereinafter and continue or repeat until the lines under test are proven tight to the satisfaction of the Owner. Furnish all materials, pumps, gauges, plugs, etc., required for tests. Notify the Engineer in advance of tests so he may witness same.

Sections of the system may be tested separately, but when so tested, any defect which may develop in a section already tested and accepted shall be corrected and that section re-tested. Devices or equipment which may be harmed by test pressures shall be removed or protected during tests. After testing, test systems for complete drain-ability by draining all water from piping using permanent caps, plugs, drain valves, etc. Test building water piping at 125 psig for a minimum of 4 hours before it is witnessed by Engineer, then for an additional 24 hours. Water test all exterior water mains at 125 psig.

ACCESS PANELS AND ENCLOSURES:

Provide access panels and / or enclosures at all locations required to service inaccessible valves, hair interceptors, filters, cleanouts, etc. Access panels in finished spaces shall be stainless steel. Acceptable manufacturers include Karp, Elmdor or approved equal.

HEAT TRACING:

Furnish and install UL approved self-regulating heat tracing cable for freeze protection of all water piping outside insulation envelope including backflow preventer systems. The heat trace cable shall consist of two (2) 16 AWG nickel plated copper bus wires embedded parallel in a self-regulating polymer core that varies its power output in response to temperature along its entire length. The heat trace jacket shall be a radiation cross linked polyolefin dielectric rated at 300 VAC at 105°F with a VW-1 flame resistance and shall have a outer braid of tinned copper for a ground path.

Heat trace shall be installed in strict accordance with manufacturer's instructions after pressure testing and immediately before pipe insulation. The heat trace shall be resistance tested by a licensed Electrician at the expense of the Plumbing Contractor. Trace system shall be connected to GFCI protected power by the Electrical Contractor, at the expense of the Plumbing Contractor.

Domestic water heat trace cable shall be Model HSX-A-120V manufactured by Thermon or equal by RayChem.

PIPE AND VALVE IDENTIFICATION:

Furnish and install flexible, permanent, color-coded, plastic-sheet pipe markers that comply with ANSI A13.1 on all exposed piping (including piping above lay-in ceiling) not to exceed 10' o.c., equal to Seton SetMark pipe markers.

Furnish and install brass valve tags with 1/4" high letters identifying operation / maintenance of piping system, equal to Seton No. M4506.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

GENERAL:

Furnish and install a complete sanitary drain, waste and vent system as shown on the drawings and as specified herein.

No waste or vent piping buried below slab shall be smaller than 2". Make any change in flow direction or grade gradually with proper curved fittings. Make all junctions with wye branches or wye and eighth bend. Sanitary tees may be used for vertical junctions. Size pipe per drawings.

Keep piping clean during construction. Seal all clean-outs and fixture connections. Remove all earth or foreign matter. Bed, fill and compact all line trenches according to Section 15150 or as detailed on the plans to prevent strain on joints, damage or settling.

Set all water closet fittings, floor drains, clean-outs, etc., carefully, using a spirit level. Confirm final floor elevations. The Plumbing Contractor shall have a journeyman present at all times while General Contractor is pouring concrete to insure proper installation of work in this Contract.

Install all piping with 1/4" per foot slope wherever possible but with minimum slopes as follows: 3" and less - 1/4" per foot; 4" and larger - 1/8" per foot.

DRAIN, WASTE AND VENT PIPING BELOW SLAB:

Construct all building sewers and building drain lines below floor slabs and outside of building walls, unless indicated otherwise on the drawings, with Schedule 40 PVC-DWV Pipe, ASTM D-2665, marked to indicate that it complies with this standard. Pipe shall be manufactured by Charlotte Pipe and Foundry or equivalent. All installations shall conform to installation instructions of the Plastic Pipe Institute, manufacturer, and/ or local ordinances. In all cases, approved cleaner, primer and solvent cement designated for the specified material shall be used.

DRAIN, WASTE AND VENT PIPING ABOVE FLOOR SLAB:

All waste and vent piping above the floor slab shall be Schedule 40 PVC-DWV in accordance with Commercial Standards CS272-65, or CS270-65, or ASTM Standards D2665-68 or D2661-67. All plastic pipe and fittings shall bear the NSF Seal of Approval, and such other markings as required by the aforementioned standards. Fittings shall be molded, fully recessed, socket type designed for solvent welded joints. All plastic piping shall be installed and joined in strict accordance with the pipe manufacturer's instructions. Plastic waste and vent pipe shall not be used in any return air plenum unless it is fully encased in a fireproof covering or as required by any code.

DRAIN AND WASTE PIPING BELOW SLAB IN KITCHEN:

Drain and waste piping under slab in kitchen areas that is subject to water temperatures above 120F (Dishwasher Discharge, 3 Compartment Sink Discharge, Steam Equipment Discharge, Tilt Skillet drain, etc.) shall be Hub & Spigot cast iron pipe for a minimum of 30 feet before transitioning to PVC.

DRAIN AND WASTE PIPING EXPOSED IN KITCHEN:

Drain and waste piping exposed under kitchen sinks, dishwashers, etc. shall be 2" brushed finish stainless steel pipe. Support from equipment or floor with stainless supports per manufacturer written instructions.

TRAPS:

Provide each fixture with a trap when connection to drainage system is required. Place each trap as near to fixture as possible. No fixture shall be double trapped.

PIPE STORAGE:

If possible, pipe should be stored inside. Otherwise, store pipe on dry, level ground free from sharp objects. Protect stored pipe from ultraviolet exposure as required. Refer to manufacturer's recommendations for rack or pallet storage and freezing temperatures.

PIPE HANGERS AND SUPPORTS:

Support Schedule 40 PVC- DWV pipe with carbon steel adjustable clevis-type hangers, 5' o.c. with 3/8" threaded rod. Chain, strap, perforated bar, or wire hangers will not be permitted. Where required, provide suitable concrete inserts in masonry or concrete during laying or placing of those materials. Acceptable manufacturers are B-line, PHD, Gulf State Hangers, and Grinnell.

PIPE SLEEVES:

Provide pipe sleeves where all pipe passes through floors, utility platforms, walls, roofs, etc. Size sleeves for insulated pipe to accommodate both pipe and insulation. Sleeves for piping masonry or concrete walls, floors, beams, or roof, shall be of black steel pipe of standard weight, unless otherwise specified or shown. Vertical sleeves through floors shall extend at least 1" above finished floor (4" through utility platforms).

ROOF VENT FLASHING:

Vents through roof shall be flashed with 4 lbs. lead or 16 oz. copper extending 12" each way from the vent. Provide lead collar, soldered to, and extending from flashing up, around, and turned down a minimum of 1" into top of vent.

CLEAN-OUTS:

Provide clean-outs at the base of all plumbing stacks, 2'-0" above finish floor if required by local codes; at all changes in direction of all sewers; and wherever indicated on the drawings.

All cleanouts shall be as manufactured by Smith, Josam, or equal by Zurn.

FLOOR, WALL, AND CEILING PLATES:

Where pipes pass through floors, finished walls or ceilings, fit with chromium plated cast brass plates or chromium steel plates as specified hereinafter. Plates shall be large enough to completely close hole around pipes, and shall be square, octagonal, or round, with least dimension not less than 1.5 times larger than diameter of pipe. Secure plates in an approved manner. Plates shall be Beaton-Caldwell No. 3A for floor and No. 40 for walls and ceilings.

PRESSURE TESTS:

The engineer shall be notified several days before testing is to be conducted and all tests shall be conducted in presence of engineer. Prior to notifying the engineer, the Contractor shall have successfully tested the piping. The Contractor shall bear the expense of the engineer's services if the tests prove unsuccessful after the engineer has been summoned by the Contractor to observe the test.

Water test all interior soil, waste, vent, and drain piping with 10' head pressure before connecting to exterior sewers and before connecting to fixtures. Water shall remain in each system for at least 4 hours. Leaks shall

be repaired and tests repeated until system fulfills this test. Systems may be tested in sections, but each joint between sections shall be tested. Do not exceed 25' head pressure on any joint.

Water test all exterior sanitary sewers with 4'-0" minimum head (above the invert) at the highest point of the sewer. Infiltration or exfiltration shall not exceed 50 gallons per inch diameter per mile per 24 hours.

Contractor shall use video camera to detect installation deficiencies such as excessive deflections, damaged pipes, leaking joints, etc. Engineer's and / or Owner's representative shall be on site to witness videotaping of all sewer piping. Contractor shall provide two (2) video tapes with corresponding diagrams for Owner's record.

END OF SECTION

PART I: GENERAL

RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

SUMMARY

- A. This Section includes plumbing fixtures and trim, faucets, other fittings, and related components.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 7 Section "Joint Sealants" for sealing between fixtures and walls, floors, and counters.
 - 2. Division 15 Section "Valves" for general-duty valves used as supply stops.
 - 3. Division 15 Section "Plumbing Specialties" for backflow preventers and other specialties not specified in this Section.

DEFINITIONS

- A. Accessible: Plumbing fixture, building, facility, or portion thereof that can be approached, entered, and used by physically handicapped, disabled, and elderly people.
- B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, showerheads and tub spouts, drains and tailpieces, traps and waste pipes. Pipe fittings, tube fittings, and general-duty valves are included where indicated.

SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each plumbing fixture category and type specified. Include selected fixture, trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- C. Provide wiring diagrams from manufacturer for electrically operated units.
- D. Maintenance data for plumbing fixtures and components to include in the operation and maintenance manuals specified in Division 1.

QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category from one source and by a single manufacturer. Exception: Where fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for this category.
- B. Regulatory Requirements: Comply with requirements of CABO A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; regarding plumbing fixtures for physically handicapped people.
- C. Regulatory Requirements: Comply with requirements of Architectural and Transportation Barriers Compliance Board's (ATBCB) "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" regarding plumbing fixtures for physically handicapped people.

- D. Energy Policy Act Requirements: Comply with requirements of Public Law 102-486, "Energy Policy Act," regarding water flow rate and water consumption of plumbing fixtures.
- E. Listing and Labeling: Provide electrically operated fixtures and components specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Product Options: Drawings indicate size, profiles, dimensional requirements, and characteristics of plumbing fixtures and are based on specific types and models indicated. Other manufacturers' fixtures with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

DELIVERY, STORAGE, AND HANDLING

- A. Deliver plumbing fixtures in manufacturers protective packing, crating, and covering.
- B. Store plumbing fixtures on elevated platforms in dry location.

PROJECT CONDITIONS

- A. Field Measurements: Coordinate roughing-in and final fixture locations and verify that plumbing fixtures can be installed to comply with original design and referenced standards.

PART II: PRODUCTS

PLUMBING FIXTURE STANDARDS AND ACCESSORIES

- A. Comply with applicable standards below and other requirements specified.
 - 1. Refer to the Specifications and Drawings for specific catalog numbers and required fittings.
 - 2. Fixture Manufacturers:
 - a. Vitreous China Fixtures: Kohler, American Standard, or Crane.
 - b. Stainless Steel Sinks: Elkay, Just Mfg. Co., Acorn, or Moen.
 - c. Electric Water Coolers: Oasis, Sunroc, Murdock, or Halsey-Taylor.
 - d. Janitor's Receptor: Fiat, Stern-Williams, or Creative Industries.
 - e. Kitchen Stainless Steel Sinks: Elkay, Just or Moen.
 - 3. Fittings Manufacturers:
 - a. Flush Valves: Sloan, Zurn or Delany.
 - b. Water closet Seats: Water closet manufacturer, Olsonite or Church.
 - c. Faucets: Delta, Zurn or Kohler.
 - d. Supplies and Stops (Loose Key): McGuire Mfg. Co., Dearborn, EBC or T&S.
 - e. Traps: McGuire Mfg. Co., EBC, Central Brass, or Dearborn.
 - f. Shower Controls: Symmons, Leonard or Acorn.

PART III: EXECUTION

EXAMINATION

- A. Examine roughing-in for potable, hot- and cold-water supply piping systems; soil, waste, and vent piping systems; and supports. Verify that locations and sizes of piping and locations and types of supports

match those indicated, before installing and connecting fixtures. Use manufacturers roughing-in data when roughing-in data are not indicated.

- B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- C. Do not proceed until unsatisfactory conditions have been corrected.

PLUMBING FIXTURE INSTALLATION

- A. Assemble plumbing fixtures and trim, fittings, faucets, and other components according to manufacturers' written instructions.
- B. Install fixtures level and plumb according to manufacturers' written instructions, roughing-in drawings, and referenced standards.
- C. Install floor-mounted, floor-outlet water closets with closet flanges and gasket seals. Install wall-hanging, back-outlet water closets with carrier and support manufacturers tiling frame or setting gage.
- F. Install wall-hanging, back-outlet urinals with gasket seals.
- G. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for handicapped people to reach.
- H. Fasten Wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified, and to building wall construction where no support is indicated. Fasten floor-mounted fixtures to substrate. Fasten fixtures having holes for securing fixture to wall construction, to reinforcement built into walls. Fasten recessed, wall-mounted fittings to reinforcement built into wall. Fasten wall-mounted fittings to reinforcement built into walls. Fasten counter-mounting plumbing fixtures to casework.
- M. Set mop basins in leveling bed of cement grout.
- N. Secure supplies to supports or substrate within pipe space behind fixture.
- O. Install an individual loose key stop valve in each water supply to fixture. Install loose key water-supply stop valves in accessible locations. Turn loose keys over to owner at project close out.
- Q. Install faucet, laminar-flow fittings with specified flow rates and patterns in faucet spouts when faucets are not available with required rates and patterns. Include adapters when required. Install supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
- S. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts when faucets are not available with required rates and patterns. Include adapters when required.
- T. Install shower, flow-control fittings with specified maximum flow rates in shower arms.
- U. Install traps on fixture outlets. Omit traps on fixtures having integral traps. Omit traps on indirect wastes, except where otherwise indicated.
- V. Install escutcheons at wall, floor, and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons where required to conceal protruding pipe fittings.
- W. Seal joints between fixtures and walls, floors, and counters using sanitary-type, 1 -part, mildew-resistant, silicone sealant according to sealing requirements specified in Division 7 Section "Joint Sealant." Match sealant color to fixture color; provide white, unless noted on drawings otherwise.

PART IV: COMMISSIONING

CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
 - 1. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other Division 15 Sections.
- B. Supply and Waste Connections to Plumbing Fixtures: Refer to plumbing fixture schedules at the end of this Section for fitting sizes and connection requirements for each plumbing fixture.
- C. Supply and Waste Connections to Equipment Specified in Other Sections: Connect equipment with supply inlets, supply stops, supply risers, and traps specified in this Section. Use fitting sizes required to match connected equipment. Connect fittings to plumbing piping.
- D. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. Where manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.
- E. Arrange for electric power connections to fixtures and devices that require power. Electric power is specified in Division 16 Sections.

FIELD QUALITY CONTROL

- A. Verify that installed fixtures are categories and types specified for locations where installed.
- B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized and demonstrate proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

ADJUSTING AND CLEANING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers, hot-water dispensers, and controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at drinking fountains, electric water coolers, faucets, shower valves, and flushometer valves having controls, to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.
- E. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Include the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.

PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of fixtures for temporary facilities, except when approved in writing by Owner.

END OF SECTION

PART I - GENERAL

RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

SUMMARY

- A. This Section includes Plumbing Specialties for water distribution systems; and soil, waste and vent systems.

SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Submit product data including rated capacities of selected models and weights (shipping, installation, and operation). Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections.

PART II - PRODUCTS

MANUFACTURERS

- A. Acceptable Manufacturers:
 - a. Backflow Preventers:
 - i. Ames Co., Inc.
 - ii. Hersey Products, Inc., Grinnell Corp.
 - iii. Watts Regulator Co.
 - iv. Wilkins Regulator Div., Zurn Industries, Inc.
 - b. Water Pressure Regulators:
 - i. Spence Engineering Co., Inc.
 - ii. Watts Regulator Co.
 - iii. Wilkins Regulator Div., Zurn Industries, Inc.
 - c. Specialties:
 - i. Josam Co.
 - ii. Smith by Jay R. Smith Mfg. Co. Div., Smith Industries, Inc.
 - iii. Watts Regulator Co.
 - iv. Woodford Manufacturing Co. Div., WCM Industries, Inc.
 - v. Zurn by Hydromechanics Div., Zurn Industries, Inc.

CLEANOUTS

- A. Exterior Surfaced Areas: Round cast nickel-bronze access frame and non-skid cover.
- B. Exterior Un-Surfaced Areas: Line type with lacquered cast iron body and round epoxy coated gasketed cover.
- C. Interior Finished Floor Areas: Lacquered cast iron, two-piece body, round with scoriated cover in service areas and round with depressed cover to accept floor finish in finished floor areas.
- D. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless-steel access cover secured with machine screw.

WATER HAMMER ARRESTORS

- A. ANSI A112.26.1; sized in accordance with PDI WH-201, pre-charged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psig working pressure.

TRAP SEAL PRIMER VALVE:

- A. ASSE 1018; water supply fed type, fully automatic 125psig minimum working pressure, Bronze body with atmospheric vented drain chamber, ½ inch threaded or solder joint inlet and outlet connections, Chrome plated, or rough bronze finish. Unit shall be capable of being located on any active water line.

BACKFLOW PREVENTERS

- A. Reduced Pressure Back-flow Preventers: ANSI/ASSE 1013; bronze body with bronze and plastic internal parts and stainless-steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve which opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

PART III - EXECUTION

PREPARATION

- A. Coordinate construction areas to receive drains to the required invert elevations.

INSTALLATION AND APPLICATION

- A. Install specialties in accordance with manufacturer's instructions to permit intended performance.
- B. Extend clean-outs to finished floor. Lubricate threaded clean-out plugs Teflon pipe dope. Ensure clearance at clean-out for rodding of drainage system.

- C. Encase exterior clean-outs in concrete flush with grade.
- D. Install water hammer arrestors complete with accessible isolation valve.

END OF SECTION 15430

PART I: GENERAL

Furnish and install insulation for hydronic and air distribution systems where shown on plans, and specified below.

HW PIPE INSULATION:

Insulate hydronic system piping, fittings, flanges, unions, etc. Insulation shall be a jacketed glass fiber pipe covering, 1.5" thick for pipe sizes 1.5" & less, 2" thick for pipes sizes 2" & above with flame resistant vapor barrier jacket meeting ASTM C547 and UL Classified.

Insulation shall be Knauf Earthwool 1000 or equal by Owens-Corning or Johns-Mansville. Provide pre-formed PVC jacket covers over insulated fittings such as els, tees, valves, etc. and over all piping in boiler room (see below).

CHILLED WATER PIPE INSULATION:

Insulate chilled water system piping, fittings, flanges, unions, etc. Insulation shall be a condensation control jacketed glass fiber pipe covering, 1.5" thick for pipe sizes 2 1/2" & less, 2.0" thick for pipes 3" to 4", & 2.5" thick for pipes 5" & above with flame resistant vapor barrier jacket meeting ASTM C547 and UL Classified.

Insulation shall be Knauf Earthwool 1000 or equal by Owens-Corning or Johns-Mansville. Provide pre-formed PVC jacket covers over insulated fittings such as els, tees, valves, etc. and over all piping in boiler room (see below).

BOILER ROOM PIPE INSULATION COVER:

Furnish & install pre-formed PVC jacketing over insulated piping & fittings in boiler room equal to Proto Corporation LoSmoke 161°F PVC 25/50 Rated. Provide following colors: HEAT = red, CHILLED WATER = blue, MAKE-UP WATER = DOMESTIC WATER by P.C. = green.

EQUIPMENT INSULATION:

Insulate hydronic system equipment including but not limited to chilled water expansion or compression tanks, pumps, storage tanks, heat exchanger vessels, etc. Insulation shall be a cellular block or urethane unicellular type with flame resistant vapor barrier jacket meeting ASTM and UL standards.

DUCTWORK INSULATION:

Furnish and install all-service faced duct wrap consisting of a blanket of glass fibers factory-laminated to a reinforced foil / kraft (FRK) vapor retarder facing on all supply, ventilation, and non-lined return air ductwork.

Duct wrap shall comply with NFPA 90 performance standards. Duct wrap insulation shall be Knauf Multi-purpose, 2-3/16" minimum thickness 0.75 lb/cf or 2" thick 1 lb/cf density with installed R-value = 6.0, or approved equal by Owens-Corning or Schuller.

PART II: EXECUTION

Install system according to manufacturer's written instructions. Drawings indicate only general arrangement of piping, fittings, and specialties

PIPE INSULATION INSTALLATION:

The Contractor shall provide all insulation as required on all piping as specified hereinafter and/or as indicated. All insulation shall be installed in a workmanlike manner by qualified workers in the regular employ of the Contractor.

Install insulation according to manufacturer's instructions.

All insulation shall be applied to clean, dry surfaces butting all sections firmly together and finishing as specified hereinafter. All vapor barriers shall be sealed and shall be continuous throughout. No staples shall be used on any vapor barrier jacket. All vapor barriers shall be of the fire-retardant type.

Insulation of all insulated lines shall be interpreted as including all pipe, valves, fittings, and specialties comprising the lines, except flanged unions and screwed unions on hot piping. Insulation over fittings shall be of equal thickness as the adjoining pipe insulation. Unless otherwise specified or directed, insulation for fittings and flanges shall be of the permanent type.

PIPE INSULATION PROTECTION:

Support of pipe shall be on the outside of the insulation. The insulation at each support shall be rigid and of an equal thickness and finish as the adjoining pipe insulation; the length to coincide with the saddles.

PIPE IDENTIFICATION:

Furnish and install flexible, permanent, color-coded, plastic-sheet pipe markers that comply with ANSI A13.1 on all chilled, hot, & condensate piping (including piping above lay-in ceiling & visible from utility platform) not to exceed 15' o.c. manufactured by Seton Products, MSI, or equal. Provide directional arrows. Verify verbiage with Engineer, i.e., chilled water supply or return, hot water supply and return, etc.

DUCT SEALANT:

Prior to insulating, all duct joints (except gasketed joints), seams and connections shall be sealed with brush-on type water-based sealant equal to United-McGill Duct Sealant. Apply in accordance to manufacturer's instructions and / or recommendations.

DUCT INSULATION INSTALLATION:

Before applying duct wrap, sheet metal ducts shall be clean, dry, tightly sealed at all joints and seams as specified, sealant applied and inspected by Engineer.

Duct wrap insulation shall be cut to "stretch-out" dimensions as provided in instructions, and a 2" piece of insulation removed from the facing at the end of the piece of insulation to form an overlapping staple and tape flap.

Install duct wrap insulation with facing outside so that tape flap overlaps insulation and facing at other end of piece of duct wrap. Insulation shall be tightly butted. If ducts are rectangular or square, install so insulation is not excessively compressed at duct corners. Seams shall be stapled approximately 6" on center with outward clinching staples. Where a vapor barrier is required, seal with pressure-sensitive tape matching the facing, either plain foil or PRK backing stock.

Where rectangular ducts are 24" in width or greater, duct wrap insulation shall be additionally secured to the bottom of the duct with mechanical fasteners such as pins and speed clip washers, spaced on 18" centers (maximum) to prevent sagging of insulation. Adjacent sections of duct wrap insulation shall be tightly butted with the 2" tape flap overlapping. Where a vapor barrier is required, seal all tears, punctures,

and other penetrations of the duct wrap insulation facing with tape or mastic to provide a vapor tight system.

DUCT LINER:

Removed from Spec, not allowed on this project.

PART III: WARRANTY

Manufacturer shall guarantee all insulation as installed to be free from manufacturing defects for a period of one year from startup not to exceed twenty-four months from shipping to job site under normal use.

PART IV: COMMISSIONING

Prior to pre-final construction review, Contractor shall repair all insulation tears and damage.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

CONDENSATE PIPING:

Condensate piping shall be 1-1/4" diameter minimum pipe and fittings installed in strict accordance with the manufacturer's and industry guidelines unless noted otherwise on the drawings. Provide copper or cast-iron piping. Slope pipe a minimum of 1/4" per foot and support with clevis-type hangers at 5'-0" o.c.

INSULATION:

Insulate pipe with 3/8" wall white Polymer foam insulation by IMCOA or 1/2" thick closed cell rubber pipe insulation, Armstrong AP Armaflex or equal by Rubatex, prior to making joints. Fabricate mitered covers over elbow fittings. Insulation sections shall be jointed using Armstrong 520 Adhesive. Follow all manufacturers' installation instructions in strict accordance. Splitting insulation or the use of duct tape to join insulation sections will not be permitted on this project.

PIPE SUPPORT:

Provide clevis-type hangers on 5'-0" centers and within 12" of elbows.

TESTING:

Fill fan coil and air handler condensate pans from utility sinks and allow to flow into storm sewer prior to ceiling installation and pipe insulation. Repair all observed leaks as required.

PIPE IDENTIFICATION:

Furnish and install permanent color-code plastic sheet pipe markers with directional arrows. See also section 15740-4.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

SCOPE OF WORK:

Provide complete systems of piping and fittings for all services, including water system piping, cold water make-up, valves, fittings, joints, hangers, supports, expansion joints, pipe guides, and insulation.

SUBMITTALS:

Shop drawings shall be submitted for the following:

- a. piping & fittings
- b. welding procedure & qualification specification
- c. valves / strainers / flow control devices / test plugs
- d. gauges

BUILDING PIPE INSTALLATION:

All pipe, valves and fittings shall comply with American Standards Association Code and/or local codes and ordinances (no foreign fittings accepted). Cut pipe accurately to measurements established at building or site, and work into place without springing or forcing, properly clearing all windows, doors and other openings or obstructions. Excessive cutting or other weakening of building to facilitate piping installation will not be permitted. Piping shall line up flanges and fittings freely and shall have adequate unions and flanges so that all equipment can be disassembled for repairs. Test all piping prior to concealing.

All welded pipe and fittings shall be delivered to job with machine beveled ends. Where necessary, beveling may be done in field by gas torch, in which case surfaces shall be thoroughly cleaned of scale and oxidation after beveling. No miter connections will be permitted in welded work.

Screwed piping shall have tapered threads cut clean and true and shall be reamed out clean before erection. Each length of pipe, as erected, shall be upended and rapped to free it of any foreign matter. All piping shall be closed with factory installed caps until prior to installation.

Threaded fittings shall be malleable iron conforming to ANSI B16.3 (150 psig W.O.); welded fittings shall be standard weight Schedule 40 black steel conforming to ASTM A-120. Weld-o-lets may be used in lieu of fitting for branch take-offs from mains 2" or larger provided that the branch take-offs is two or more sizes smaller than the main. No "stub-ins" will be permitted. Threaded joints shall be made with Teflon sealing compound applied to the male threads only.

The Contractor shall coordinate the routing of all piping with other contractors prior to installation. Furnish and install valves as required to allow for complete system drain down.

ABOVE GROUND PIPING:

Above ground piping inside building shall be:

Schedule 40 black steel pipe bearing name of manufacturer and weight at regular intervals. Fittings for pipe 2-1/2" and smaller shall be malleable iron 150 lb. screwed and bonded (ASA B16.3). Fittings for pipe 3" and larger shall be welded forged carbon steel (ASTM 234) with same thickness as adjacent piping. Use only long radius elbows. Contractor may choose to use grooved steel piping (Victaulic or Equal) in systems that do not exceed 180F degree water temperatures in lieu of welded steel piping.

Carbon Steel or Copper tubing utilizing a mechanical compression joint (Viega MegaPress, ProPress or Equal) for pipe sizes 4" and less may also be used. *At contractor's option, Aquatherm, Nyrone, or Uponor Non-Metallic piping rated for Hydronic heating & cooling systems may be used in lieu of metallic pipe. See Non-Metallic Hydronic Piping Specification 15740A.*

WELDING QUALITY ASSURANCE

Piping shall comply with the provisions of the latest edition of the ASME code for pressure piping, ANSI/ASME B31.1 - Power Piping.

All welding shall be performed by persons currently having an ASME license in accordance with Section IX of the ASME Code. All welding shall be performed in accordance with the North Carolina Boiler Rules. Names, identification stamps, and copy of certification of all welders on job shall be submitted to the Designer and kept for historical purposes in the project files. At the request of the Designer, this contractor shall (at his or her expense) have an independent testing agency test and qualify the welding procedures used in the construction of weldments and the performance of welders who apply these procedures.

At least two weeks before any welding is performed, the Contractor shall submit to the Designer a copy of each welding procedure specification required for the job, together with the procedure qualification record as required by Section IX of the ASME boiler and pressure vessel code.

At least two weeks before any welder shall perform any welding the Contractor shall submit to the Designer a copy of the manufacturer's record of welder or welding operator qualification tests as required by Section IX of the ASME boiler and pressure vessel code.

Welded joints shall be made by first properly beveling the surfaces to be welded, cleaning the mating surfaces, then tack-welding the joint to assure proper alignment prior to completing the weld. Weld metal shall be continuous around the joint and shall be deposited in such a manner that the sides and bottom of the surfaces or edges joined are thoroughly fused with the surface of the weld and have proper reinforcement and width.

The first weld of each welder shall be witnessed and visually inspected and approved by Engineer before further welding by that welder is permitted. Provide at least five (5) working days notice to Engineer.

Weld examination shall be in accordance with ANSI/ASME B31.1 - Power Piping. In addition, the Owner may at any time hire an independent agent to examine the welds using whatever method he or she deems suitable, whether required by ANSI/ASME B31.1 or not.

Any welds not meeting the acceptance criteria of ANSI/ASME B31.1 - Power Piping for the examination technique used shall be repaired in accordance with ANSI/ASME B31.1., at no cost to the Owner.

VALVES:

For pipe sizes 3" and larger, valves shall be threaded lug butterfly type, with ductile iron body, teflon or neoprene seat, and bronze disc; Grinnell Series 8000 or equal by Posi-Seal or DEMCO. For pipe sizes 2.5" and smaller, use ball valves non-shock pressure rated up to 400 psi equal to Grinnell Series 3500 with cast bronze body and ball. Soft solder ends at temperatures less than 470°F to prevent damage to seat. Nibco or Apollo shall be considered equal.

Check valves shall be spring loaded, manufactured by Febco, Watts or equal.

STRAINERS:

Strainers shall be placed at pumps, coils, chillers, boilers, make-up water and where indicated on the drawings. Strainer body specs shall be same as valves. Screen element shall be rated for 20 mesh/850 microns up to 1-1/2", perforations shall not exceed 1/16" for 2" units and larger.

AUTOMATIC FLOW CONTROL VALVES / STRAINERS

Combination automatic flow control valves strainers with pressure and temperature parts shall be installed where shown on the drawings to control the water flow to the scheduled values. These valves shall automatically control the flow of water to the units to within 5% of the indicated flow over a pressure range of not less than 14 times the minimum necessary for proper flow. All internal working parts shall be nickel plated brass or type 300 passivated stainless steel. Where indicated on drawings, provide plug blow down drain, manual air vent, add dielectric union options. See details on drawings. Flow control devices shall be Auto Flow FV-BC/SV-BC by Flow Design Inc. or Flow-ConY, or Ultra-Z by Griswold.

TEST PLUGS:

Provide where shown on drawings, 1/4" brass, 1000 psi, 250 degrees F test plugs with Nordel penetrable membrane for measuring pressure and temperature. The plug shall have a firm fitting brass cap. The case shall have a double insert of Nordel to prevent momentary leakage after long periods of penetration. Test plugs shall be manufactured by Peterson Engineering (Pete's plugs) or approved equal.

PIPE SLEEVES:

Provide pipe sleeves where pipe passes through floors, beams, walls, roofs, etc. Size sleeves for insulated pipe to accommodate both pipe and insulation. Sleeves for piping masonry or concrete walls, floors, beams, or roof, shall be of black steel pipe of standard weight, unless otherwise specified or shown. Vertical sleeves through floors shall extend at least 1" above finished floor.

PIPE HANGERS AND SUPPORTS:

Pipe hangers and supports shall be of a size to support water filled piping with a safety factor of 5 based on hanger or support ultimate tensile strength. Hangers and supports shall be manufactured by B-Line Systems or approved equal by Grinnell or PHD. Size hangers for all insulated piping to fit over insulation with an acceptable clearance.

Clevis hangers for water piping shall be equal to B-Line Fig. 3100. Roller type hangers shall be equal to B-Line Fig B-3110. Vertical pipes shall be supported by wall brackets equal to Grinnell Fig. 261. Hanger rod shall be equal to B-Line Systems Fig B-3205. Pipe insulation protection shield shall be B-Line Fig. 3151. Piping hanger and support installation shall allow for uniform expansion and contraction at all times. Use B-Line Fig. B-3050 or equal universal C-clamps for attachment to structure.

PIPE INSULATION:

See Section 15500, Mechanical Insulation.

PRESSURE TESTING:

Test all piping and connections installed under this contract. Do testing prior to painting, backfilling, insulating or concealment within building construction. Trenches may be backfilled prior to pressure tests, but not before work has been visually inspected by the Owner. If pressure tests indicate leaks in piping, it shall be the Contractor's responsibility to determine location of leaks, excavate as required, repair leaks, and backfill at his expense.

Perform each test as specified hereinafter and continue or repeat until the lines under test are proven tight to the satisfaction of the Owner. Furnish all materials, pumps, gauges, plugs, etc., required for tests. Notify the Engineer in advance of tests so he may witness same. Sections of the system may be tested separately, but when so tested, any defect which may develop in a section already tested and accepted shall be corrected and that section retested. Devices or equipment which may be harmed by test pressures shall be removed or protected during tests. After testing, test systems for complete drainability by draining all water from piping using permanent caps, plugs, drain valves, etc. Test building water piping at 100 psi for a minimum of 4 hours before it is witnessed by Engineer. Final test system shall be performed at 100 psi for a minimum of 24 hours.

PIPE AND VALVE IDENTIFICATION:

Furnish and install flexible, permanent, color-coded, plastic-sheet pipe markers that comply with ANSI A13.1 on all piping (including piping above lay-in ceiling) not to exceed 15' o.c. manufactured by Seton Products, MSI, or equal. Provide directional arrows. Verify verbiage with Engineer, i.e., chilled water supply or return, hot water supply and return, etc. Stencil-type spray-on pipe labels will not be accepted on this project.

Furnish and install brass valve tags with 1/4" high letters identifying operation / maintenance of piping system.

TEMPERATURE GAUGES:

Thermometer shall be a dial type, minimum 4.5" diameter black on white dial, stainless case, variable angle mount, copper bulb, with magnifying glass cover. Temperature range shall be 30°F to 240°F (-10°C to 110°C) with a 1% scale range accuracy. Approved manufacturers are Weiss, Trerice, Marsh Instruments, and Weksler.

PRESSURE GAUGES:

Pressure gauges shall have a minimum 4.5" diameter black on white dial, be stem-mounted, provided with stop locks, have a phosphor-bronze bourdon tube and a corrosion resistant brass movement with a 1% scale range accuracy. Pressure Range shall be selected by Engineer. Approved manufacturers are Trerice, Weiss, and Marsh instruments.

THERMOMETER WELLS:

Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2" extension for insulated piping and cap nut with chain fastened permanently to thermometer well.

HEAT TRACING:

Furnish and install UL approved self-regulating heat tracing cable for freeze protection of all hydronic piping outside insulation envelope (unless system contains antifreeze solution). The heat trace cable shall consist of two (2) 16 AWG nickel plated copper bus wires embedded parallel in a self-regulating polymer core that varies its power output in response to temperature along its entire length. The heat trace jacket shall be a radiation cross linked polyolefin dielectric rated at 300 VAC at 105°F with a VW-1 flame resistance and shall have a outer braid of tinned copper for a ground path.

Heat trace shall be installed in strict accordance with manufacturer's instructions after pressure testing and immediately before pipe insulation. The heat trace shall be resistance tested and connected to GFCI protected power by a licensed Electrician at the expense of the Contractor.

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HEATING, VENTILATING, AND AIR CONDITIONING
HYDRONIC PIPING SYSTEMS

Domestic water heat trace cable shall be Model HSX-A-120V manufactured by Thermon or equal by RayChem.

ALUMINUM JACKET:

Furnish and install an aluminum jacket on all piping located on the building exterior or in other places subject to physical damage. Wrap insulated pipe and heat race wiring with 0.016 inch thick embossed aluminum jacketing with longitudinal slip joints, secured with 3/8" wide bands.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

SCOPE OF WORK:

Contractor shall be responsible flushing, cleaning, and purging of hydronic system piping and pre-treatment of system with corrosion and deposit inhibitors plus microbiocide.

System treatment shall be performed by a competent water treatment company.

Provide a single two gallon chemical bypass feeder, ChemTreat no. 70600880 or Owner pre-approved equal by Dearborn or Calgon.

SYSTEM FLUSHING & PRE-CLEANING:

Clean and flush system before fan coil or air handler connection. After flushing system thoroughly, provide a written certification to Architect that the piping system is free of all dirt, trash, grease, oil, foreign objects, etc.

Make fan coil or air handler connection and clean and re-flush system.

Remove and clean all system strainers then replace.

SYSTEM CLEANING & PRE-TREATMENT PROCEDURE:

1. Check to verify the system has no leaks by whatever method is applicable (visual, hardness test of water from AHU condensate pans, dye, pressure monitoring, make up water meter readings, etc.).
2. Check the PRV and make up bypass valve for proper operation. Purge expansion tank and strainers to remove accumulated rust.
3. Install ball valve on strainers.
4. If the water is dirty:
 - A. Drain and refill until the water clears. Purge air.
 - B. If the water remains dirty after circulation, or if the system must be cleaned while on line, start a running flush (bleed off while make up maintains system pressures) until the water clears. Make sure all control valves are cycled so the entire system is flushed.
5. Add cleaners and inhibitors to the system.
 - A. 5000ppm CT 30 Chill Water Systems (CT 23 may be substituted in hot water systems where there is a minimum of copper in the system).
 - B. 200 ppm CL4123
 - C. 200 ppm CL4400
6. Circulate system for 8-24 hours. During this time, blow down at all low points and deadlegs. Cycle all control valves to make certain the entire system is cleaned. Blow out and / or clean strainers as needed.
7. If the entire system will completely drain by gravity, turn off system. Drain and refill with clean water. Circulate water and start a running flush. If the system will not completely drain by gravity, start a running flush.

8. Continue the running flush until samples collected prior to the make up point to meet the following requirements:
 - A. The pH is less than 9.0.
 - B. The water is clear.
 - C. Iron content is <0.5 or as low as it will go (old systems will not normally be <0.5 after cleaning).
9. Monitor the above parameters frequently. If the iron content rises on two consecutive samples and the water is clear, consider the flushing as complete.
10. Add the appropriate inhibitors:
 - A. CL2871: 4500 ppm – chill water
6000 ppm – hot water
 - B. NCL2150: 250 ppm – chill water
250 ppm – hot water (if water will not be >180 degrees F year round)
11. Use and disposal of chemicals and cleaning solutions should comply with appropriate regulations.
12. The system shall have a minimum of each of the following treatments:
 - A. Molybdenum 300 ppm
 - B. Sodium Nitrite 300 ppm
 - C. Tolytriazole 20 ppm

WARRANTY:

Schedule water Treatment Company to take water test samples prior to 11 month warranty inspections.

Make corrections and file report to Architect.

END OF SECTION

**DIVISION 15B
SECTION 15800**

**HEATING, VENTILATING, AND AIR CONDITIONING
AIR DISTRIBUTION & ACCESSORIES**

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

DUCTWORK:

Material and thickness: Ducts shall be rectangular and fabricated of prime quality, re-squared, tight-coat-galvanized, steel sheets. All duct construction shall equal or exceed SMACNA "Low Pressure Duct Construction Standards", or SMACNA "High Pressure Duct Construction Standards", depending on system pressure.

DUCT CONSTRUCTION:

All ductwork shall be fabricated from prime, number one grade galvanized sheet metal conforming to ASTM A-924-94, G-90. Gauges for duct sizes shall be minimum as follows:

<u>Low Pressure, <1" ESP</u>		<u>Medium Pressure, <2" ESP</u>	
26 Ga.	Up to 30 inches	26 Ga.	Up to 26 inches
24 Ga.	Up to 40 inches	24 Ga.	Up to 30 inches
22 Ga.	Up to 54 inches	22 Ga.	Up to 36 inches
20 Ga.	Up to 96 inches	20 Ga.	Up to 84 inches

Standard flat slips and drives shall be used on ductwork with long dimensions not exceeding 18". On ductwork over 18" standing S cleats, Ductmate angles or equivalent reinforcing shall be used.

Ducts shall have supplemental stiffening as required to prevent drumming and to provide a structurally sound assembly. All ducts except those to which rigid board type insulation is to be applied shall have all sides cross-broken. All duct dimensions shown on drawings are "inside clear". The sizes of acoustically lined ducts shall be increased accordingly. Ducts shall be smooth on inside.

Fabricate all ductwork to prevent seams or joints being cut for installation of grilles, diffusers, or registers. All duct joints and seams shall be fabricated and installed with joints and seams made air tight.

SPIRAL DUCT:

Where round duct is indicated on the drawings by diameter, provide spiral duct constructed in accordance with ASHRAE and SMACNA standards, and G-60 galvanized steel meeting ASTM A-517. Duct fittings shall be of welded seam construction, and male fitting slip connection shall be a minimum of 2" from bead to end.

Where exposed duct is detailed on the drawings, provide superior fabrication grade double wall insulated spiral duct with 1" thick insulation meeting NFPA 90A flamespread requirements, welds ground smooth, paintable galvanized steel, perforated liner, and paintable flanged type gasketed duct connection fittings.

Spiral pipe shall be manufactured by United McGill, Hamlin Sheetmetal, Linx Ind, or Spiral Pipe of Texas.

HANGING DUCTS:

Support ducts from building structure in accordance with SMACNA "Low Pressure Duct Construction Standards", or SMACNA "High Pressure Duct Construction Standards", depending on system pressure.

OBSTRUCTIONS AND RESTRICTIONS:

Where possible, avoid locating any pipe, wire, structural member or other obstruction inside of duct. Take particular care to avoid obstructions in elbows. Where obstruction cannot be avoided, the rules

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specified by SMACNA "Low Pressure Duct Construction Standards", or SMACNA "High Pressure Duct Construction Standards", depending on system pressure, shall apply. Where ducts pass through non-rated walls, protect ducts and/or insulation from contact with wall by .5 inch filler of noncombustible material and flange perimeter of wall opening with sheet metal.

CHANGE IN DUCT SHAPE & DIRECTION:

Where the area at the end of the transformation results in an increase in area from the beginning of the transformation, the slope of the transformation shall meet SMACNA "Low Pressure Duct Construction Standards", or SMACNA "High Pressure Duct Construction Standards", depending on system pressure.

In general, keep changes in direction and changes in shape to minimum permitted by distribution requirements and building conditions. Make turns with ells, as conditions necessitate, in accordance with SMACNA "Low Pressure Duct Construction Standards", or SMACNA "High Pressure Duct Construction Standards", depending on system pressure.

SPLITTERS AND/OR HAND DAMPERS:

Provide splitters or butterfly dampers for adjustment of distribution to respective branches where indicated on drawings and elsewhere as required to properly balance system. Dampers shall meet SMACNA "Low Pressure Duct Construction Standards", or SMACNA "High Pressure Duct Construction Standards", depending on system pressure.

DEFLECTORS:

Provide deflectors at all branch take-offs, and elsewhere as required. Fabricate of galvanized steel sheet of same thickness as used in ductwork of corresponding size. Securely anchor vanes to duct or casing, and brace free-standing edges as specified for turning vanes in elbows.

ACCESS DOORS:

Provide access doors of suitable size where required to service equipment. Fabricate doors of 24 U. S. Gauge galvanized steel hinged to a 24 gauge galvanized mounting frame, and provide with fastening devices to give tight closure on felt gasket. Doors for insulated duct shall be double panel construction with 1" rigid insulation material between metal panels.

ACCESS PANELS:

Construct access panels as specified for access doors, and provide at all locations where any operable device occurs inside ducts, i.e., dampers, controls, filters, louvers, fire dampers, etc.

SPECIALTIES:

Where drawings or specifications require that ducts be insulated, make provision for neat insulation finish around damper operating quadrants, splitter adjusting clamps, access doors and similar operating devices. A metal collar equivalent in depth to insulation thickness (and of suitable size to which insulation may be finished) shall be mounted on duct. Insulation on duct shall extend continuously through walls, etc.

Provide extension collars for outlets, air guide vanes, and other specialties where they occur in the ducts.

DUCT SILENCER:

Provide pre-fabricated sound attenuating duct silencers where indicated on the drawings constructed of minimum 22 ga. galvanized casing metal, perforated metal inner liner with aerodynamic leading & trailing edges constructed in accordance with ASTM E84 for flame & combustion retardancy. Attenuation data

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SECTION 15800**

**HEATING, VENTILATING, AND AIR CONDITIONING
AIR DISTRIBUTION & ACCESSORIES**

shall be provided with submittal. Pressure drop shall not exceed 0.75" w.g. Approved manufacturers are Rink Sound Control and United McGill.

AIR DISTRIBUTION DEVICES:

Diffusers, registers, and grilles shall be installed indicated or implied on drawings. All ceiling diffusers and grilles shall be designed to minimize ceiling and/or wall discoloration, and shall be model and finish as indicated on drawings. Air distribution manufacturer and Contractor shall be jointly responsible for and certify delivery or exhaust. (See Testing Section for duct system.)

Items scheduled on the drawings are used for design purposes. Similar units as manufactured by Nailor Industries, Titus, Krueger, Price and Metal*Aire shall be considered equal. Maximum dba shall be 30. If indicated on the drawings, supply and return grilles shall be equipped with volume dampers of the opposed blade type. The dampers are to be adjustable from the face. All grilles, registers and diffusers shall have white baked enamel finish, unless indicated otherwise.

DAMPERS:

Balancing dampers shall be installed at each branch run to allow for proper balance of the system. Each damper shall be supplied with a quadrant locking device which extends beyond the ductwork for external adjustment.

FIRE DAMPERS: See Section 15825

FLEXIBLE CONNECTIONS:

For low velocity duct work (less than 2400 FPM), provide flexible connections at inlet and outlet of each fan connected to ductwork and elsewhere as indicated. Flexible connections shall be 6 inches wide, waterproof and fireproof, and shall be 24 gauge Metaledge Ventfab, as manufactured by Ventfabrics, Inc.

DUCT SEALANT:

Prior to insulating, all duct joints (except gasketed joints), seams and connections shall be sealed with brush-on type water-based sealant equal to United-McGill Duct Sealant. Apply in accordance to manufacturer's instructions and / or recommendations.

CLEANING DUCT SYSTEM:

Upon complete installation of ducts, clean entire system of rubbish, plaster, dirt, etc., before installing any outlets. After installation of outlets and connections to fans are made, blow out entire systems with all control devices wide open.

DUCTWORK INSULATION: See Section 15500, Mechanical Insulation

DUCT LINER: Removed. Not allowed on this job.

FLEXIBLE DUCTS:

Flexible ducts shall be not less than 3' or greater than 8' long of flexible air duct with a sum total of 90° maximum of bends. Flexible duct shall be UL 181 insulated Class 1 rated for medium pressure applications (up to 8" w.g.). Flexible duct shall be ATCO Rubber Products no UPC-018 or as manufactured Owens Corning or approved equivalent. Flexible duct shall meet all requirements of NFPA No. 90A. Duct shall be complete with 1.25" Type B factory applied insulation. Make connection to metal duct take-off with (2) nylon straps over tape.

Commented [AC1]: Removed from specification because duct liner is not allowed on school jobs:

"For ten feet of return duct from air handler connection or where indicated or detailed on the drawings, acoustically line ducts, plenums, and casings with 1" thick liner. See Section 15500, Mechanical Insulation."

DIVISION 15B
SECTION 15800

HEATING, VENTILATING, AND AIR CONDITIONING
AIR DISTRIBUTION & ACCESSORIES

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART I: GENERAL

SCOPE:

Provide all plant, labor, materials, accessories, and equipment required to install the fire dampers as shown on the accompanying plans and specified in this document.

WORK INCLUDED:

- a. Fire & smoke dampers
- b. Fuse links
- c. Access doors

PART II: PRODUCTS

Furnish fire dampers as shown on the drawings as required by the North Carolina State Building Code.

FIRE DAMPERS:

Fire dampers shall have the following characteristics:

- a. Fire dampers shall be constructed in accordance with NFPA Bulletin No. 90A, and shall be labeled and listed by Underwriter's Laboratories for the purpose for which they are being used. They shall have fusible links, spring locks, and shall be so arranged that air flow will hold blades closed.
- b. The fire dampers shall be Type B with the opened damper out of the air stream and not restrict free area.
- c. Location and type of fire dampers are shown on the drawings.
- d. Dampers mounted horizontally shall be equipped with spring loading for closure.
- e. Fusible Link shall be rated at 165° F

Fire dampers shall be equal to those manufactured by Ruskin. Access doors shall be insulated sheet metal equal to those manufactured by Ventfabrics.

ACCESS DOOR:

See section 15800.

PART III: EXECUTION

Install fire dampers in accordance with SMACNA requirements and manufacturer's instructions.

Provide access doors for purpose of resetting fire linkages in the ductwork and, where needed, in the building walls, floors or ceilings. Lay-in ceilings do not require access doors.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART I: GENERAL

Provide all labor, materials, accessories, and equipment required to furnish and install louvers as shown on the accompanying plans and specified in this document.

PART II: PRODUCTS

STATIONARY LOUVERS:

Louvers shall have the following features:

- a. The unit shall have a rain proof exterior with a built-in backdraft damper (for exhaust applications)
- b. The blades shall be constructed of not lighter than 14 gauge 6063T5 extruded aluminum @ 3" o.c.
- c. Frame shall be constructed of not lighter than 12 gauge extruded aluminum.
- d. Provide blade edge of vinyl or rubber to give minimum leakage shall be 1 cfm/ft² at 1/2" SP.
- e. Furnish extended sill and insect screen
- f. Finish shall be Kynar 500 with 20 year warranty or approved equal – custom color(s) selected by Architect

Louvers shall be manufactured by Ruskin, Air Balance, Vent Products, Cesco or Reliable.

Submit (3) color samples for approval by the Architect.

PART III: EXECUTION

Install in accordance with SMACNA requirements.

END OF SECTION

GENERAL:

Furnish and install blower coil, (BC) or fan coil (FC or FCU) with type, size, and capacity as indicated on plans. Protect coil from construction dust and debris before project closeout with temporary disposable filters at unit and at return grille.

BC's and FC's shall be completely factory assembled including water coil, condensate drain pan, fan motor, filters and controls in an insulated casing in a vertical configuration. Units shall be rated and tested in accordance with ARI standard 210. Units shall be UL listed and labeled in accordance with UL 1995 for indoor blower coil units.

Vertical fan coil units shall have ducted side return air entry option as detailed on the drawings. Filters shall be accessible from side coil access panels. Provide 1 year supply of air filters as specified.

CABINET/BLOWER:

Unit casing shall be constructed of zinc coated, heavy gauge galvanized steel. Exterior surfaces shall be cleaned, and phosphatized, painted finish is optional. Casing is completely insulated with fire-retardant, permanent, odorless glass fiber material. Knockouts shall be provided for unit electrical power, water and/or refrigerant piping connections. Captive screws shall be standard on all access panels. Provide mounting subbase for vertical floor mount configurations. Subbase shall be constructed of heavy gauge, zinc coated galvanized steel with finish to match air handler unit.

Evaporator fan shall be a double inlet, double width, forward curved, centrifugal-type fan(s) with direct drive shall be standard. Thermal overload protection shall be standard on motor. Fan and motor bearings shall be permanently lubricated. Motor efficiency shall comply with NCSBC Volume X Energy Code.

WATER COILS:

Water coils shall be specifically designed and circuited for application. Provide 2-row heating coil and four or six row chilled water coil to meet design loads. Finned coil surface shall consist of aluminum plate fins securely bonded to seamless copper tubing. Coils shall be designed to allow drainage, designed for 150 psig working pressure, and tested at 350 psig.

Unit Drain pan shall be of corrosive resistant construction and have positive slope toward the drain. Provide and install a secondary overflow drain pan for each unit that is installed above a ceiling or on a mechanical platform. Install a float switch that will shut down the air handler and close the chilled water control valve upon activation. See control diagram and sequence of operation.

MANUFACTURER:

Units manufactured by Envirotec, Daikin, Carrier, Kreuger and ITC are acceptable provided all specifications are met or exceeded. (Trane Vertical Blower Coil Units 5 tons and Under are NOT acceptable)

VIBRATION ISOLATION:

Provide all equipment with vibration isolation bases equal to Vibration Mounting and Controls, Inc. (VMC), and shall be installed in strict accordance with manufacturer's instructions. Provide neoprene-in-shear mounts, VMC no. R-2 or approved equal, rated for load. Arrangement shall be in accordance with applicable details on drawings.

WARRANTY:

Provide unit with 5-year parts warranty and 2-year factory labor warranty.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

GENERAL:

Furnish and install 1 year supply of 1" air filters disposable air filters in all fan coils and 2" for air handlers. One year supply consists of four (4) sets for 60 day replacement cycle and does not include first sets installed during start-up and replacement prior to Owner acceptance of building.

Provide an air filter replacement schedule indicating size and quantity for each HVAC unit with submittal for approval.

Air filters shall be medium efficiency, pleated, disposable type. Each filter shall consist of cotton and synthetic media, media support grid, and enclosing frame. The filter shall be listed and identified on the frame as Underwriters' Laboratories Class 2.

Filter shall have not less than 2.3 square feet of media per square foot of filter face area and not less than 16 pleats per linear foot of filter face area. A 96% open area media support grid of welded wire construction, coated with rust inhibitor shall be bonded to the air exiting side of the filter. The enclosing frame shall be of high wet-strength beverage board with diagonal support members bonded to the air entering and air exiting side of each pleat. The inside periphery of the enclosing frame shall be bonded to the filter pack.

Filter shall have an average efficiency of 25-30%, and an average arrestance of not less than 90% in accordance with ASHRAE Standard 52.1-1992. The minimum MERV when tested under ASHRAE 52.2 shall be no less than MERV 9. Initial resistance at 375 feet per minute approach velocity shall not exceed 0.28" iwc

A test report corresponding to each of the aforementioned ASHRAE Standards are required submittals.

MANUFACTURER:

Filters shall be Farr 30/30 Dual 9.

Units manufactured by Flanders and American Air Filter are acceptable provided all specifications are met or exceeded.

END OF SECTION

15900 BUILDING AUTOMATION SYSTEMS

PART 1 - GENERAL

1.1. APPLICABLE SECTIONS

- A. 15910 BAS Sensors and Devices

1.2. RELATED DOCUMENTS

- A. The Contract Drawings are directly applicable to this Section, and this Section is directly applicable to them.
- B. The general provisions of the Contract, including General and Supplementary Conditions and/or Division 01 Specification Sections, are directly applicable to this Section, and this Section is directly applicable to them.
- C. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.
- D. The Request for Proposal and associated Scope of Work are directly applicable to this Section, and this Section is directly applicable to them.
- E. The Owner's BAS Master Plan is directly applicable to this Section, and this Section is directly applicable to it.
- F. Collectively, these items will be referred to as the Contract Documents.

1.3. DEFINITIONS AND ABBREVIATIONS

- A. Where definitions in Division 01 conflict with the definitions herein, Contractor will comply with the most stringent requirement.
- B. BAS Component: a generic reference to any hardware component which is provided by Contractor, including but not limited to controllers, power supplies, transformers, relays, actuators, sensors, or other devices.
- C. Building Automation System (BAS): Also referred to as Building Management System (BMS), Direct Digital Control (DDC).
- D. Building Controller: Controller, which is at, and controlling at, the building-level. Could also be a large portion of a building, such as a wing, depending on hardware capability. Generally, are the middle tier of the overall BAS network, and report up to a Building or Enterprise Supervisor. Also, generally what Device Controllers would be integrated with. See Section 2.5 System Architecture for full definition and specification.
- E. Building-Level Network (BLN): An ethernet, fiber, and/or wireless network dedicated to the BAS, which connects Building Controllers and Building Supervisors. The BLN may be a separate network from Owner's LAN, or as part of the LAN, which has been segmented to be used exclusively by the BAS. See Section 2.5 System Architecture for full definition and specification.
- F. Building Supervisor: Server, which is at, and controlling at, the building-level. Generally used when Building Controllers do not have sufficient hardware capability to support an entire building. Generally, are the middle tier of the overall BAS network, and installed on a Server in lieu of being a stand-alone piece of hardware. Also, generally what Building Controllers would be integrated with. Building Supervisors may be further integrated to an Enterprise Supervisor. See Section 2.5 System Architecture for full definition and specification.
- G. Controller: A generic reference to a BAS Controller, including but not limited to Device Controllers and Building Controllers.
- H. Contract Documents: All documents which compose the project, including but not limited to drawings, specifications, RFPs, scope of work, general conditions, and supplemental conditions.

- I. Control Panels: an assembly composed of an enclosure and one or more BAS Component(s).
- J. Critical: A special area or zone which receives specialized BAS Components.
- K. Device Controller: Also referred to as Field-Level Controller. Controller, which is at, and controlling at, at the device-level. Device in this instance is understood to reference MEP Equipment. Generally, are the lowest tier of the overall BAS network, and report up to a Building Controller. See Section 2.5 System Architecture for full definition and specification.
- L. Device-Level Network (DLN): A copper, ethernet, fiber, and/or wireless network dedicated to the BAS, which connects Device Controllers and Building Controllers. See Section 2.5 System Architecture for full definition and specification.
- M. Enterprise Supervisor: Server, which is at, and controlling at, the enterprise-level. Generally, are the highest tier of the overall BAS network, and installed on a server in lieu of being a stand-alone piece of hardware. Also, generally what Building Controllers and/or Supervisors would be integrated with. See Section 2.5 System Architecture for full definition and specification.
- N. Field-Level: See Device Controllers and Device-Level Network.
- O. Furnish: To supply and deliver to project site, ready for installation.
- P. Install: To place in position for service or use.
- Q. Local Area Network (LAN): Ethernet, fiber, and/or wireless network which connects computers and other networkable devices (printers, etc.), and has a connection to the WAN. See Section 2.5 System Architecture for full definition and specification.
- R. Manufacturer: The brand of the BAS being provided (ex: Distech, Honeywell, etc).
- S. MEP: Mechanical, electrical, and plumbing.
- T. MEP Equipment: Where MEP Equipment is used, it is understood to mean any piece of MEP Equipment which the BAS will in some way, shape, or form, interface with, via hardwired connection or integration. MEP Equipment includes, but is not limited to VAV, AHU, RTU, split systems, hot water heaters, heat exchangers, boilers, chillers, and pumps.
- U. MSI: Master Systems Integrator: see MSI section for full definition and specification.
- V. Owner: The financial provider and user of the BAS, as well as Owner Representatives.
- W. Owner Representatives: Representatives for the Owner which are on staff, contracted, or hired to protect the interests of the Owner, such as Engineers, Architects, Commissioning Agents, and other parties.
- X. Project: The facility/building as defined in the Contract Documents.
- Y. Server: A computer in which BAS software is installed on.
- Z. Sequence of Operation: The steps that MEP Equipment takes to achieve the desired operation to provide optimal comfort and/or ventilation for the Project.
- AA. Substantial Completion: Written authorization by the Owner that the project has reached a point of completion that it can be utilized.
- BB. Supervisor: A generic reference to a BAS Supervisor, including but not limited to Building Supervisors and Enterprise Supervisors.
- CC. Provide: To furnish and install, complete and ready for intended use.
- DD. Vendor: The installer, integrator, and/or contractor for the BAS being provided.
- EE. Wide Area Network (WAN): Ethernet and/or fiber-based network which connects multiple facilities via the internet. See Section 2.5 System Architecture for full definition and specification.

FF. Warranty Period: The time between Substantial Completion and the duration of Warranty, as specified.

1.4. GENERAL SPECIFICATIONS

- A. Contractor shall provide all hardware, software, configuration, programming, graphics (GUI), checkout, alarms, trending, functional testing, and commissioning necessary to provide a complete and fully functioning BAS. Contractor shall include all hardware, control wiring, wiring accessories, wiring connections, software, and programming not specifically itemized in these Specifications, which is necessary to implement, maintain, operate, and diagnose the system, now and in the future.
 - 1. Provide all necessary BAS Components on each piece of MEP Equipment to:
 - a. Perform the specified Sequence of Operation and meet the design/performance intent of the MEP Equipment.
 - b. Comply with BAS Components as shown on the control diagrams.
 - c. Comply with the point lists.
 - d. Comply with the Specifications herein.
 - e. Comply with the design intent of the BAS.
 - 2. Where the Sequence of Operation, control diagrams, points list, or specifications conflict with each other, Contractor will comply with the most stringent requirement.
- B. It is Contractor's responsibility to review all the Contract Documents and report any discrepancies to Owner.
- C. Substitutions
 - 1. Wherever the words "approved equal," "for review," or "for acceptance" are used in regard to manufactured specialties, or wherever it is desired to substitute a different make or type of BAS Component for that specified, submit all information pertinent to the adequacy and adaptability of the proposed BAS Component to Owner and secure their approval before the BAS Component is ordered.
- D. Warranty
 - 1. The entire BAS and all ancillary equipment required for its operation shall be free from defects in workmanship and material under normal use and service. If within twenty-four months from the date of Substantial Completion the installed equipment is found to be defective in operation, workmanship or materials, Contractor shall replace, repair, or adjust the defect at no cost to Owner.
 - 2. Corrective software and/or hardware modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software disks.
 - a. Modifications made which are corrective to one piece of MEP Equipment will be replicated to all MEP Equipment for consistency in programming.
 - b. User documentation will be updated in all locations, including but not limited to hard copies, Control Panel hard copies, O&Ms, and PDF copies accessible via download inside the BAS system.
 - c. Maintain revision control (i.e., v1_05) to indicate which is the latest version of all documentation, software, and programming.
 - 3. Owner reserves the right to make changes to the BAS during the Warranty Period. Such changes do not constitute a waiver of warranty. Contractor shall warrant parts and installation work regardless of any changes made by Owner unless Contractor provides clear and convincing evidence that a specific problem is the result of such changes to the BAS.

4. At no cost to Owner, during the Warranty Period, Contractor shall provide maintenance services for software including all current software updates, firmware, and hardware. Prior to the closeout of the warranty period, Contractor shall meet with Owner to address any questions or concerns and offer ongoing services to Owner.
 5. Electronic Actuators: Parts and labor for 5 years from the date of substantial completion.
 6. Air and Water Flow Meters: Parts and labor for 3 years from the date of substantial completion.
- E. Training
1. Provide four hours of training for Owner personnel, and/or maintenance contractor, on the operation and maintenance of the BAS.
 2. Provide four hours of training for Owner personnel, and/or maintenance contractor, on the operation and maintenance of the BAS, 90 to 180 days after Substantial Completion.
 3. Provide one certification class for Owner personnel and/or maintenance contractor. Class shall be Manufacturer-approved, instructor-led, in-person training. Lodging and expenses will be covered by Owner.
- 1.5. ALLOWANCES AND COSTS
- A. Not Used.
- 1.6. CODES AND REFERENCE STANDARDS
- A. Comply with all current federal, state, and local codes, requirements, ordinances, and regulations, in accordance with the authority(ies) having jurisdiction (AHJ).
 - B. Comply with the National Electric Code (NEC).
 - C. Comply with all manufacturer guidelines and requirements.
 - D. Comply with all Owner rules, guidelines, procedures, and requirements, including Owner IT.
 - E. The latest published edition of a reference shall be applicable to the Project unless identified by a specific edition date.
 - F. Electrical Components, Devices, and Accessories: UL listed and labeled for the intended application and location as defined in NFPA 70.
 - G. All applicable materials, installation, and workmanship shall comply with the applicable requirements and standards addressed within the following references:
 1. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - a. ASHRAE Standard 135: BACnet - A Data Communication Protocol For Building Automation And Control Networks
 - b. ASHRAE Standard 62.1: Ventilation and Acceptable Indoor Air Quality
 - c. ASHRAE Standard 90.1: Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings
 2. Underwriters Laboratory (UL)
 - a. UL Standard 916: UL Standard for Safety Energy Management Equipment
 - b. UL Standard 508A: UL Standard for Safety Industrial Control Panels
 1. Institute of Electrical and Electronics Engineers (IEEE)
 - a. IEEE 802: Family of LAN Standards
 2. American National Standards Institute (ANSI)
 - a. ANSI/Consumer Technology Association (CTA) 709: Family of Standards
 3. LonMark International
 4. BACnet Testing Lab

1.7. COORDINATION OF WORK AND INTEGRATION

- A. Certain LonMark, BACnet, Modbus, and other products, systems, and interface devices, may be provided by other trades via MEP Equipment. Examine the Contract Documents to ascertain the requirements to install, wire, program, commission, and/or interface to these systems. Particular attention must be paid towards the interface boards submitted by the various MEP Equipment providers. It is Contractor's responsibility to verify the submitted interfaces will integrate properly into the BAS. Report any discrepancies to Owner. Discrepancies brought to Owner's attention after the procurement of that piece of MEP Equipment will be integrated at no additional cost to Owner. Contractor will provide additional interface(s) needed to integrate piece of MEP Equipment.
- B. Contractor shall review MEP Equipment for compliance with control diagrams, Sequence of Operation, and points lists. Report any discrepancies to Owner.
- C. Wherever work interconnects with work of other trades, coordinate with other trades and with Owner to ensure that all trades have the information necessary so that they may properly install all the necessary connections and equipment.
- D. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. Verify all locations with Owner and/or General Contractor prior to installation.
- E. Coordinate sources of 120V power with the Electrical Contractor and Owner. Extend power from source(s) as needed.
- F. Coordinate location of data ports/drops to the LAN/WAN with the Electrical Contractor and Owner.
- G. Coordinate shipping of BAS Components to another Contractor or manufacturer for factory-installation.

1.8. SPARE PARTS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Provide one replacement for each unique actuator, Controller, thermostat, wall module, or any other BAS Component provided.

1.9. CONTRACTOR QUALIFICATIONS

- A. Qualifications may be requested from Contractor prior to the bidding process. Owner reserves the right to not allow Contractors to bid if they do not meet the qualifications or provide them in a timely manner. Qualifications will be provided for all items below in an orderly format for review by Owner.
- B. Contractor shall have a successful history in the design and installation of the BAS being provided that consists of web-browser monitoring and control of LonWorks, BACnet, and/or Modbus Device Controllers. These projects must be on-line and functional such that Owner can observe the BAS in full operation. Include proper references, contact names, emails, and phone numbers of these reference projects, with a minimum of five projects similar to this Project.
- C. Contractor shall demonstrate experience in BAS installations for not less than five years, in BAS installation projects with point counts equal to this Project, and systems of the same character as this Project.
- D. Contractor shall have specialized in and be experienced with the installation of the proposed product line for not less than five years, on at least ten projects of similar size and complexity.
- E. Contractor shall be factory authorized by manufacturer of product line and be in good standing with the manufacturer.
- F. Contractor shall be located within 50 miles of Project.

- G. Contractor shall be a certified installer/integrator by the manufacturer of the BAS being provided.
- H. Contractor shall have a minimum of three, certified personnel by the manufacturer of the BAS being provided.
- I. Contractor shall have a minimum of three personnel who are certified in LonWorks, BACnet, and/or Modbus line(s) of controls to be installed as part of this project.
- J. Be of sufficient size to provide service, including both routine maintenance and emergency support within 24 hours upon receipt of request.

1.10. ACTION SUBMITTALS

A. Product Data Submittal

- 1. Submit manufacturer's technical product data for each BAS Component, including but not limited to Controller, sensor, actuator, relay and panel, indicating dimensions, capacities, performance, electrical characteristics, and material finishes. Also include installation and start-up instructions.
 - a. When manufacturer's product datasheets apply to a product series rather than a specific product model, clearly indicate, mark-through, and highlight only applicable information.
 - b. Generic submittals will be automatically rejected.
- 2. Submit documentation indicating LonMark, NICs, and/or BTL compliance and include Protocol Implementation Conformance (PIC) Statements.

B. Shop Drawings Submittal

- 1. Submit shop drawings. Shop drawings will include:
- 2. Bill of Materials (BOM): indicating equipment served, quantity, manufacturer, point range (i.e. 0-10 in. w.c.), sensor range (i.e. 0-10V), and model number for all BAS Components being provided.
 - a. Disconnect Schedule: additionally, indicating MCA, MOP, voltage, # of phases, size, NEMA rating, # of poles, and neutral (Y/N).
 - b. Starter Schedule: additionally, indicating horsepower, voltage, # of phases, size, NEMA rating, and bypass.
 - c. VFD Schedule: additionally, indicating horsepower, voltage, # of phases, size and NEMA rating, bypass (Y/N), number of contactors (if bypass), disconnect (Y/N), and disconnect type (fused/non-fused).
 - d. Hydronic Valves (Pressure-Dependent): additionally, indicating gpm, line size, calculated Cv and design pressure drop, actual Cv and actual pressure drop, close-off pressure, type (ball/globe/butterfly), connection, valve size, 2/3-way, mixing/diverting (if 3 way), service (2-position/modulating), and fail position.
 - A) Actual pressure drop will correct for any line-size to valve-size restrictions per the manufacturer's data.
 - B) Actuator will be scheduled with the valve per the standard BOM.
 - e. Hydronic Valves (Pressure-Independent): additionally, indicating gpm, line size, selected valve gpm, maximum valve gpm, min/max pressure drops (for proper operation), close-off pressure, type (ball/globe/butterfly), connection, valve size, 2/3-way, mixing/diverting (if 3 way), service (2-position/modulating), and fail position.
 - A) Actual pressure drop will correct for any line-size to valve-size restrictions per the manufacturer's data.
 - B) Actuator will be scheduled with the valve per the standard BOM.

- f. Steam Valves: additionally, indicating lb/hr, inlet pressure, outlet pressure, line size, calculated Cv and design pressure drop, actual Cv and actual pressure drop, close-off pressure, type (ball/globe/butterfly), connection, valve size, 2/3-way, mixing or diverting (if 3 way), service (2-position/modulating), and fail position.
 - A) Actual pressure drop will correct for any line-size to valve-size restrictions per the manufacturer's data.
 - B) Provide sizing methodology/calculations for manufacturer selected.
 - C) Actuator will be scheduled with the valve per the standard BOM.
- g. Air Flow Metering Stations (AMFS): additionally, indicating duct size, output, network capable (LonWorks/BACnet), and number of probes/sensors.
- h. Water/Steam Flow Meters: additionally, indicating line size, output, network capable (LonWorks/BACnet), and flow meter style/type.
- i. Damper Schedule: additionally indicating, duct size, blade type, leakage, and construction.
- j. VAV schedule: indicating VAV type, K factor, and max/min/reheat flows.
3. Schematic Flow Diagram: schematic representation of MEP Equipment. Diagram will show all BAS Components on schematic, point name, and point number (i.e. UI-1). Where MEP Equipment varies slightly, schematic will be clearly diagramed to indicate any differences between each piece of MEP Equipment. Stating the schematic as "typical" is not acceptable.
4. Wiring Diagram: indicating power, signal, and control wiring. Where terminal blocks are provided, provide indication where wiring terminates to terminal block.
5. Sequence of Operation: Any modifications proposed to the Sequence of Operation will be clearly marked up as part of the shop drawings or submitted as an annotated Microsoft Word document in addition to the shop drawings. A default Contractor Sequence of Operation, included without regard to the Contract Document's Sequence of Operation, will result in a rejected submittal.
6. Control Panel Diagrams: indicating panel faces, with layouts of any BAS Components to be installed in the panel face, BAS Component locations inside panel, and labeling of BAS Components.
7. One-line diagram for all controllers showing the network layout. Where Project is to connect with an existing BAS, indicate how the new network will integrate with the new and/or existing BAS Components.
8. Indicate anticipated device ID, Network number, MAC Addressing, and Max Masters for all BACnet devices. Provide logical schema for BACnet addressing.
9. Individual floor plans with device (controllers, routers, sensors, etc.) locations with all interconnecting wiring routing including space sensors, Device and Building-Level Network wiring, power wiring, and low voltage power wiring.
10. Additional Requirements:
 - a. Point names will be consistent between the schematics and wiring diagrams.
 - b. Misc. Points List: where controllers being provided for other purposes are also used to control a miscellaneous point, such as an exhaust fan or lighting contactor, provide a list of those miscellaneous points in a concise format for quick identification of their location and associated Controller.
 - c. Provide a complete list of any deviations of submitted products to the specification in this document.

- d. Where existing BAS Components are being reused, such as controllers or sensors, clearly indicate (via coloring, line type, etc) the BAS Components being reused as “existing” and new components as “new.”

C. Graphics Submittal

1. Provide screen captures of graphical user interfaces developed by Contractor on previous projects. These screen shots shall represent actual work performed by Contractor and not generic work from the line of controls which Contractor represents. Screenshots will be applicable to the MEP systems as part of this project. “Generic” screenshots of MEP systems will not be accepted. Provide client contact information for Owner to validate. Any comments from the submittal process will be incorporated into the actual graphics for the project.
2. Follow Owner’s graphics standards.
3. Zoning Map
 - a. Provide submittal of graphic floorplans for markup by Owner to identify required zoning to use for scheduling. Floorplan markup will be used by Contractor to segment equipment that satisfies the identified zones.

D. Point-Naming Submittal

1. Points shall be named consistently. Provide list of point names and point conventions.
2. Point naming shall be consistent with an existing standard, such as Project Haystack.

E. IP Drop Request Submittal

1. Provide list of BAS Component(s) which need an IP drop to the LAN/WAN.
2. Provide location, quantity (if multiple per Control Panel/location), and IP address requirements (DHCP, fixed, etc), and total number of IP address reservations, including room for future growth.
3. Provide list to a minimum of ten business days’ notice prior to needing the drop.

F. Schedule/Sequence of Construction Submittal

1. Provide schedule and sequence of construction, as it pertains to the installation of the BAS, for review.

G. Functional Performance Testing (FPT) Submittal

1. Provide FPT agendas and testing procedures for review.
2. FPT should include at a minimum Sequence of Operation, point-to-point verification to graphical interface, historical data logging, and alarms testing procedures.

1.11. START-UP AND ASSOCIATED TESTING SUBMITTALS

A. Point-to-Point Testing/Checkout Sheets Submittal

1. Prior to startup of MEP Equipment, Contractor will provide checkout sheets for each piece of MEP Equipment.
2. Checkout sheets will contain at a minimum:
 - a. Equipment name and location.
 - b. Associated Controller address (MAC or Node ID), name, type, and instance number.
 - c. Point name, type (resistance, amperage, voltage, etc), and range (i.e., -5 to +5 in w.g.).

B. Start-Up Testing Submittal

1. As part of the startup of MEP Equipment, Contractor will provide start-up testing sheets for each piece of MEP Equipment.
2. Start-up testing sheets will contain at a minimum:

- a. Equipment name and location.
 - b. Sequence of Operation and step-by-step procedure used to check programming and configuration.
 - c. Any modifications required to Sequence of Operation for MEP Equipment performance.
 - d. Final graphical screens.
 - e. PID tuning parameters for each loop.
- C. Adjusting and Calibration Submittal
- 1. As part of the startup of MEP Equipment, Contractor will provide a calibration submittal for each piece of MEP Equipment.
 - 2. Calibration submittal will contain at a minimum:
 - a. Equipment name and location.
 - b. Point name, type, and range.
 - c. Sensor type and manufacturer's stated accuracy.
 - d. Calibration type (single point, two point, etc).
 - e. Checking, adjusting, and calibration data.
 - f. Sensor installed accuracy.
 - g. Sensor pass, fail, replaced, etc.
 - h. Calibration equipment used and associated certificates of calibration, including expiration dates.

1.12. CLOSE-OUT SUBMITTALS

- A. Operating and Maintenance Manuals
- 1. Provide all documentation as required in the submittal processes to-date, updated to as-built conditions.
 - 2. In addition, provide the following:
 - a. Include control response, settings, set points, throttling ranges, gains, reset schedules, adjustable parameters, and limits.
 - b. A table (or similar) of all Testing, Adjusting and Balancing (TAB) values for each piece of MEP Equipment and BAS-calibrated equipment, such as airflow metering stations (AFMS).
 - c. Any O&Ms for equipment not originally included in the submittal, in addition to product data.
 - d. Accurately record actual set points, calibrations/offsets, and settings of controls, final Sequence of Operation, including changes to programs made after submission and approval of shop drawings and including changes to programs made during specified testing.
 - e. Database of all point names.
- B. As-Built Shop Drawings
- 1. Provide PDF of shop drawings which have been corrected to reflect the as-built state.
 - a. Incorporate any redlines made in field during installation.
 - b. Update Sequence of Operation to reflect MEP Equipment operation as changed during installation, commissioning, and/or functional performance testing.
 - c. Provide reference to being "as-built" version on each sheet of the shop drawings.
 - 2. Provide hard copy of appropriate shop drawing page(s) inside each Control Panel.

C. Software Closeout

1. Provide all usernames, passwords, software, GUI, databases, licenses, and application programming tool(s) to Owner.
2. Provide software backup of entire BAS and associated components on digital media for Owner record. Coordinate file location of automatic backup of software with Owner.

D. Reference 3.11 Closeout for additional requirements.

1.13. MATERIALS AND EQUIPMENT

- A. All materials shall meet or exceed all applicable referenced standards, federal, state, and local requirements, referenced standards, and conform to codes and ordinances of the AHJ.
- B. Materials shall be new, the best of their respective kinds without imperfections or blemishes and shall not be damaged in any way. Used equipment shall not be used in any way for the permanent installation except where Contract Documents specifically allow existing materials to remain in place.
- C. To the extent practical, all equipment of the same type serving the same function shall be identical and from the same manufacturer.

1.14. COLORS AND LABELING

A. Provide BAS Components consistent with the following color requirements.

- | | |
|---------------------------|--|
| 1. Control Panels | Blue |
| 2. Conduit | Blue |
| 3. Input/Output Wiring | Yellow |
| 4. 24VAC/DC Power | Pink |
| 5. BACnet Copper Wiring | Orange |
| 6. LonWorks Copper Wiring | Purple |
| 7. Modbus Copper Wiring | Blue |
| 8. Ethernet/Fiber Cable | Consistent with color of primary communication protocol. |
| 9. Tubing | Black with White Stripe |

B. Provided BAS Components with the following labeling requirements.

1. Controllers
 - a. Vinyl or nylon label, 1/2 inch or greater in height, black text on white background, adhesive backed, printed with MEP Equipment served by Controller, permanently mounted.
2. Control Panels
 - a. Two-layer engraved phenolic or engraver's plastic tag, 1 inch or greater in height, adhesive backed, engraved with MEP Equipment served by panel, permanently mounted.
3. Input/Output Wiring
 - a. Nylon or self-laminated wire-wrap label, 1/2 inch or greater in height, black text on white background, adhesive backed, printed with BAS Component connected to cable and cable number, permanently mounted at termination to terminal block in Control Panel on cable jacket.
 - b. Premade labels or wire marker tape is not allowed.
4. BAS Component
 - a. Vinyl or nylon label, 1/2 inch or greater in height, black text on white background, adhesive backed, printed with MEP Equipment served and BAS Component purpose (ex. AHU-1 SF Start/Stop), permanently mounted.

PART 2 - PRODUCTS

2.1. MANUFACTURERS AND VENDORS

- A. Subject to the Specifications and requirements herein, the BAS will be provided by (listed in alphabetical order):
 - 1. Schneider Electric StruxureWare by Schneider Electric
- B. Products by the manufacturer listed shall be used for Device and Building Controllers. Sensors, actuators, valves, dampers, and other BAS Components may be manufactured by others as indicated.

2.2. GENERAL

- A. All Device and Building Controllers installed for the project shall not be limited in their ability to communicate with a specific brand, Manufacturer, or Vendor of the BAS. They shall also be constructed in a modular fashion to permit the next generation and support components to be installed in replacement of, or in parallel with, existing components.
- B. Owner shall receive ownership of all job-specific configuration documentation, data files, software and/or code developed for the Project. This shall include all custom, job-specific software code, databases, and documentation for all configuration and programming that is generated for the Project and/or configured for use with the Device and Building Controllers or Building and Enterprise Supervisors, and any related LAN, WAN, Intranet, and Internet connected routers and devices.
- C. Any and all required IDs and passwords for admin and programming-level access to any BAS Component or software program shall be provided to Owner.
- D. All Device and Building Controllers installed for the project shall not be limited in their ability to communicate with a specific brand/Manufacturer or Vendor of the BAS. They shall also be constructed in a modular fashion to permit the next generation and support components to be installed in replacement of, or in parallel with, existing components.
- E. Device and Building Controllers shall have the ability to perform energy management routines via preprogrammed function blocks or template programs.
- F. Browser-based access: A remote/local user using a standard browser will be able access all BAS facilities and graphics via the LAN or direct connection, with proper username and password. Only HTML5 browser-based graphical user interfaces (GUI) is acceptable. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer, Edge, Firefox, or Chrome.
- G. Remote data access: The system shall support browser-based remote access over the Internet to the building data.
 - 1. The Contractor shall coordinate with Owner IT to ensure all remote browser access is protected with the latest BAS software updates.
 - 2. The Contractor shall coordinate with Owner IT to ensure a VPN (Virtual Private Network) is installed to protect Owner from cyber-attacks.
- H. Systems Configuration Database: The system architecture shall support maintaining the systems configuration database on a Supervisor server on the LAN. User tools for BLN and/or DLN management shall be provided and licensed to Owner and shall allow unrestricted configuring, updating, maintaining, and expanding of all current devices, configurations and settings.
- I. Database Schema shall be published and provided to Owner to facilitate easy access to BLN and DLN data.
- J. Owner shall be the named license holder of all software associated with any and all incremental work on the project. Contractor will coordinate with Owner IT for any requirements regarding software/hardware licensing.

2.3. DEVICE COUNT AND SOFTWARE MAINTENANCE AGREEMENTS

- A. All Device Controllers, Building Controllers, and Supervisors which have a license structure to where only a certain quantity of BAS Components or devices can connect to it shall be selected such that there is a minimum 25% capacity for future BAS Component or device connections. (i.e. if there are 80 connected devices, the license shall allow for $80 \times 1.25 = 100$ potential device connections (20 extra device connections possible).
- B. All Building Controllers and Supervisors which have a license structure requiring a Software Maintenance Agreement (SMA) shall be for a period of five years.

2.4. SYSTEM PERFORMANCE

- A. Description: The BAS shall comply with the following minimum performance requirements. Performance requirements are based on a fully functioning BAS with all trends and alarms enabled:
 - 1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
 - 2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
 - 3. Object Command: Reaction time of less than 2 seconds between operator command of a binary object and device reaction.
 - 4. Object Scan: Transmit change of state and change of analog values to control units or workstation within 6 seconds.
 - 5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.

2.5. SYSTEM ARCHITECTURE

- A. BAS framework will be the latest stable release from the Manufacturer of the BAS (as identified by Contractor) and will be compatible with all other BAS systems of the same Manufacturer. Provide version and release suggested to Owner for approval before installation. Where the incorrect software version is installed, it shall be corrected at no additional cost to Owner.
- B. The system architecture provided shall incorporate hardware and software resources sufficient to meet the functional requirements of these Specifications. The Building and Device-Level Network shall be based on industry standard open platforms as specified herein, and utilize commonly available operation, management, and application software. All software packages and databases shall be licensed to Owner to allow unrestricted maintenance and operation of the BAS. Contractor shall include all items not specifically itemized in these Specifications that are necessary to implement, maintain, and operate the system in compliance with the functional intent of these Specifications.
- C. Reference 4.1 Network Diagram for diagram of System Architecture layout.
- D. The system architecture shall consist of a Wide Area Network (WAN), a Local Area Network (LAN), a Building-Level Network (BLN), and one or more Device-Level Network(s) (DLN), as well as an Enterprise Supervisor, a Building Supervisor, Building Controller(s), and Device Controller(s), as applicable.
 - 1. Wide Area Network (WAN): WAN infrastructure provided by Owner. Contractor will coordinate with Owner IT for configuration (ports, firewall, etc) for a successful BAS installation.
 - a. The WAN infrastructure shall be used to connect the Enterprise Supervisor to the Building Supervisor and/or Building Controller(s).

2. Local Area Network (LAN): LAN infrastructure provided by Owner. Contractor will coordinate with Owner IT for configuration (ports, firewall, etc) for a successful BAS installation.
 - a. The LAN infrastructure shall be the connection point to the WAN for the BAS, and also serve as the BLN.
3. Building-Level Network (BLN): BLN shall be a segmented network on the Owner's LAN.
 - a. The BLN shall be used for connection of Building Controller(s) and/or Building Supervisor only. No Device Controller(s) shall be connected to the BLN.
4. Device Level Network (DLN): DLN infrastructure provided by Contractor.
 - a. DLN will be BACnet TCP/IP (Ethernet).
 - b. Contractor will provide one or more DLNs to maintain network speeds as specified herein.
 - c. Additional DLNs of a different protocol than listed may be added to integrate unique pieces of equipment not provided by Contractor, however all Contractor-provided equipment shall be consistent with the DLN above.

2.6. SYSTEM ARCHITECTURE, ADDITIONAL REQUIREMENTS

- A. BAS framework will be the latest stable release from the Manufacturer of the BAS (as identified by Contractor) and will be compatible with all other BAS systems of the same Manufacturer. Provide version and release suggested to Owner for approval before installation. Where the incorrect software version is installed, it shall be corrected at no additional cost to Owner.
- B. Prior to bid, where a modification to the System Architecture is desired, Contractor will obtain permission for the proposed System Architecture. Contractor will provide documentation with proposed modifications and how they will improve the System Architecture as specified. If not approved, Contractor will provide the System Architecture as specified.
- C. Prior to the bid, Contractor may request for additional connections to the WAN/LAN beyond the ones specified herein. Should those connections be disallowed, Contractor shall provide additional BLN(s) or DLN(s) at no additional cost to Owner.
- D. Capacity of any BLN or DLN shall be limited to 70% of the allowable device count to allow for future minor modifications or expansions to the network. Provide calculations on request.
- E. Device Controllers shall communicate on a hardwired network.
- F. Twisted-Pair Based Device Level and/or Building Level Networks (DLN/BLN):
 1. BACnet MS/TP networks where the baud rate for equipment is "fixed" and cannot be changed shall be segmented from the main DLN(s). The main DLN(s) will not be slowed to accept Device Controllers with slower baud rates than the majority of the Device Controllers can achieve.
 2. ARCnet and/or Token-Ring based DLNs shall not be acceptable.
 3. The communication speed between Device Controllers shall be sufficient to ensure fast system response time under any loading condition. At a minimum, network speed shall be minimally 78K bits per second (LonWorks FTT-10A), 19.2K bits per second (Modbus RTU), 76,800 baud (BACnet MS/TP).
 - a. Where speeds must be reduced, provide justification to Owner for approval.
 4. Provide a maximum of 40 LonWorks FTT-10A controllers per segment. Provide a maximum of 25 BACnet MS/TP controllers per segment. Provide a maximum of 25 Modbus RTU controllers per segment.
 - a. Controller counts may be increased where specifically recommended/approved by the Manufacturer and system performance will be achieved as specified. If network

performance suffers due to excessive controllers, Contractor shall provide additional BLN(s) or DLN(s) at no additional cost to Owner.

G. Ethernet Based Device Level and/or Building Level Networks (DLN/BLN):

1. Where DLN is an ethernet-based network (vs traditional copper twisted-pair network), the requirements of the BLN shall also apply to the DLN.
2. Ethernet-based BLN or DLN shall be consistent with Owner IT standards and requirements, and at a minimum IEEE 802.3 Ethernet over Fiber or Category 6 cable with switches and routers that support 1000base-T gigabit Ethernet throughput. Provide all routers, switches, and other hardware for functionality.

2.7. DEVICE CONTROLLERS

- A. Provide a Device Controller for each piece of MEP Equipment, or as specifically identified.
- B. Provide a new Device Controller for each of the existing Device Controller(s) and/or pieces of MEP Equipment. Coordinate with the RFP and/or Scope of Work. Provide additional Device Controller(s) as required.
- C. Utilize existing Device Controllers. Coordinate with the RFP and/or Scope of Work. Provide new Device Controller(s) as required.
- D. General
 1. Device Controllers shall fundamentally communicate with the protocol as specified in the System Architecture for the DLN. Device Controllers which communicate over a different protocol and then convert to the specified protocol via a protocol converter, router, or gateway are not acceptable.
 2. All Device Controllers shall be able to communicate peer-to-peer without the need for a Building Controller and shall be capable of assuming all responsibilities typically assumed by a Building Controller.
 3. Any Device Controller shall be able to act as a Master to allow for the exchange and sharing of data variables and messages with any other Controller connected on the same communication cabling. So called "Slave Controllers" are not acceptable.
 4. A dedicated Device Controller will be provided for each piece of MEP Equipment. Controller "sharing," where one Controller does one or more pieces of MEP Equipment, is not allowed, unless specifically approved by Owner.
 5. Each Device Controller shall have a minimum of 10% spare capacity for each point type for future point connection, rounded up to the nearest whole number. Where device controller contains universal input/output capability, provide a minimum of 20% spare capacity.
 6. Performance
 - a. Each Device Controller shall have a minimum of 128MB of RAM and 32MB of non-volatile flash memory.
 - b. Each Device Controller shall have a 32-bit microprocessor operating at a minimum of 500 MHz.
 - c. Real time clock with rechargeable battery and 20 days power backup.
 - d. Minimum 16 bit A/D converter for inputs and 10 bit D/A converter for outputs.
 - e. Capable of, at a minimum:
 - A) Dry contact, counter (frequency for intended operation), 0-5/10VDC, 0/4-20mA, and resistive inputs.
 - B) Solid-state/triac style digital outputs (where floating applications are required) or relay outputs.

- C) 0-5/10VDC and 0/4-20mA analog outputs.
- 7. The control program shall reside within the same enclosure as the input/output circuitry, which translates the sensor signals. The control program shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
- 8. Provide single Device Controllers with the physical and software resource count for standalone operation of each piece of MEP Equipment. The Sequence of Operation and required points for control shall reside on a single Device Controller.
 - a. Remote I/O modules (via a field-wired communications bus designed for remote I/O purposes) are acceptable for points required to achieve the Sequence of Operation.
 - A) BACnet, LonWorks, Modbus, and any other communication protocol designed for Device Controller to Building Controller communication is not acceptable for remote I/O communication.
 - B) Expansion I/O modules plugged directly into the Controller are acceptable for points required to achieve the Sequence of Operation.
 - C) Additional Device Controllers connected via the DLN are not acceptable for points required to achieve the Sequence of Operation.
- 9. Device Controllers with integral sensors or devices (i.e., a VAV terminal unit controller with integral damper actuator and pressure sensor), shall comply with the specification requirements for those sensors if they were submitted separately. If the Controller's sensors or devices do not comply, the sensors or devices will be provided separately.
- 10. Provide controllers with removable terminal blocks, where available.
- 11. BACnet Device Controller Specific Requirements:
 - a. Each BACnet Controller on the BACnet MS/TP communications trunk shall provide a loading characteristic of 1/8th load.
 - b. Provide BACnet Controllers that are BACnet Testing Laboratory (BTL) listed (v14 or later). Controllers will be marked with the BTL certified logos. Controllers must be within the following categories:
 - A) BACnet Building Controller (B-BC)
 - B) BACnet Advanced Application Controller (B-AAC)
 - C) BACnet Application Specific Controller (B-ASC)
- 12. LonWorks Device Controller Specific Requirements:
 - a. Provide LonWorks Device Controllers that conform to LonMark Certified Interoperability Standards. Components will be marked with the LonMark certified logos.
- 13. Modbus Device Controller Specific Requirements:
 - a. Provide Modbus Device Controllers that conform to the Modbus Conformance Testing Program and be independently verified by an approved third-party for conformance.
- E. Configurable Device Controllers
 - 1. Shall contain an application-specific control program which can be configured to meet the Sequence of Operation.
 - 2. Where a configurable Controller cannot be configured to meet the Sequence of Operation, a Programmable Controller will be used. Alternatively, Contractor may submit a request to modify the Sequence of Operation so that a Configurable Controller may be used in lieu of a Programmable Controller.
- F. Programmable Device Controllers

1. Shall be fully programmable and the programming software shall have a library of pre-built, tested, and user re-definable control sequences for a wide range of typical HVAC applications.
- G. Ethernet Device Controllers
1. Provide with a 2-port or greater unmanaged integrated switch.
 2. Controllers should be able to be “daisy chained” to eliminate multiple dedicated ethernet drops for each Controller.
- 2.8. BUILDING CONTROLLERS
- A. Provide Building Controller(s) with sufficient expansions to integrate DLNs while maintaining network speed, point count requirements, spare capacity, and other requirements as specified.
 - B. Building Controller(s) shall be the latest release of Schneider Electric Automation Servers.
 1. Provide with all required expansions for LonWorks FTT-10A, RS485, etc. to achieve the necessary quantity of DLN(s).
 - C. Provide sufficient quantity of Building Controllers to maintain average processing power at 70% or less. Where Building Controllers are running above 70% consistently, additional Building Controllers will be provided and DLNs rewired at no cost to the Owner.
- 2.9. BUILDING SUPERVISORS
- A. Where there is a single Building Controller, no Building Supervisor is required.
 - B. In lieu of a Building Supervisor, use Enterprise Supervisor.
 1. No computer will be installed onsite as part of the Project.
 2. For graphics that spread over multiple Building Controllers, build inside Enterprise Supervisor and link to corresponding Building Controller(s) (ex., master floorplan graphic inside Enterprise Supervisor, with hyperlinks to IPs for Building Controllers in each wing).
- 2.10. ENTERPRISE SUPERVISORS
- A. Integrate Building Supervisor and/or Building Controller(s) to the existing Enterprise Supervisor.
- 2.11. CONTROL PANELS AND ENCLOSURES
- A. Enclosures will be provided for:
 1. All MEP Equipment which requires a Device Controller(s) and do not have an enclosure for a Device Controller(s) included as part of the MEP Equipment.
 - a. Controller(s) installed inside of MEP Equipment shall only be done so in spaces/enclosures designed for a Controller to be installed (i.e. a VAV controls enclosure). The fact a Controller fits inside the space does not constitute being designed for a Controller to be installed. Controller shall not be installed exposed on the outside of any MEP Equipment or in a plenum, even if Controller is plenum rated.
 2. All Building Controller(s).
 - B. General
 1. Enclosures shall have continuously welded and ground smooth seams, have doors that open 180 degrees, concealed and continuous hinge, and ground studs on door and body.
 2. Indoor/inside enclosures shall be NEMA/UL Listed Type 1. Enclosure shall be powder-coated steel, consistent with color chart herein. Outdoor/outside Enclosures shall be NEMA/UL Listed 3R or 4X. Enclosure shall be power-coated steel consistent with color chart herein or stainless steel.
 3. All enclosures will be provided with a removable backplate to which BAS Components will be fastened. No BAS Components will be fastened to the enclosure body. BAS

Components, such as pilot lights and switches, displays, and operator interfaces may be mounted to the enclosure door, so long as they are designed to do so. No component will sacrifice or downgrade the NEMA rating of the enclosure.

4. Maintain separation between Class 2 wiring and other wiring, such as power, for both field and factory connections.
 5. Where the Specification conflicts with Control Panel requirements in Division 16, Contractor will comply with the most stringent requirement.
- C. Control Panels with one BAS Component
1. May be field assembled and shall not require compliance with UL508A.
 2. Field wiring may terminate directly to BAS Component.
 3. Control Panels with one BAS Component may voluntarily comply with the more stringent requirements for Control Panels with greater than one BAS Component.
- D. Control Panels with greater than one BAS Component
1. Shall be assembled and installed in accordance with UL508A. Control Panel may be certified as "Open," allowing for precursory installation of enclosure or reuse of an existing enclosure in field. Control Panel may also be certified as "Closed," where the enclosure and BAS components are provided as a single assembly.
 2. Control Panels which have more than one BAS Component are required to be provided prewired to numbered terminal blocks. All BAS Components and terminal blocks will be fastened to the removable backplate and wired between the BAS Components and terminal block at Contractor's panel shop. Field wiring to the Control Panel shall be terminated to the opposite side of the Control Panel. The terminal block will serve as the demarcation point between factory/shop wiring and field wiring. At no point shall field wiring cross the terminal block and be wired directly to a factory/shop-installed BAS Component. Any BAS Component that was intended to be in the field, such as a relay, will not be installed inside the enclosure in the field.
 3. Control Panels will be sized (width, height, and depth) so that all BAS Components, including but not limited to Controllers, relays, power supplies and transformers, fit inside neatly and in an organized fashion. Provide cable tray for all wire to rest in and fasten to backplate. Cable tray shall be sufficiently sized for future expansion and/or service loop for field-wiring.
 4. The design intent of the Control Panels is to have the ability to, in the future, disconnect all field wiring from the terminal blocks, remove the backplate with old control components, install new backplate with new control components and reconnect wire to the terminal blocks. Contractor will maintain design intent with their panel design and installation.
 5. Control Panels which are modified after UL508A listing by adding BAS Component(s) not shown on the UL508A panel drawings are 1) not allowed, or 2) require UL508A recertification from an authorized UL508A inspector. In short, 'generic' UL508A Control Panels which have power prewired but contain no BAS Component(s) as listed are not allowed.

2.12. CABLE, WIRING, TUBING, AND ACCESSORIES

- A. Comply with 15910 and Division 16.
- B. BAS cable for input and outputs shall comply to the color chart herein and have "BAS CABLE" (or equivalent) physically written on the cable from the cable manufacturer at regular intervals.
- C. BAS cable for LonWorks shall comply to the color chart herein and have "LONMARK" physically written on the cable from the cable manufacturer at regular intervals. BAS cable for

BACnet shall comply with the color chart herein and have "BACNET" physically written on the cable from the cable manufacturer at regular intervals. BAS cable for other protocols will have the appropriate protocol written on the cable.

- D. All control wiring and tubing shall be plenum rated, no riser cable or tubing is allowed. Conform with NFPA 262 Flame Test for approved plenum use without conduit.
- E. Provide with integral ripcord.
- F. Treat cable with a lubricant to increase cable pulling productivity and efficiency and to decrease the risk of cable damage due to excessive pulling strengths. A non-staining lubricant shall be applied to coat the full length of the cable during the manufacturing process. The lubricant shall produce a low coefficient of friction on the cable jacket material that reduces pulling friction by up to 70%. The lubricant shall continue to reduce friction after it has dried; remaining as a slippery film that retains lubricity for months after use. The cable lubricant shall comply with the physical and performance requirements of Telcordia Standard, TR-NWT-002811, and Generic Requirements for Cable Placing Lubricants. The lubricant shall not contain solvents nor have a flash point.
- G. BACnet and Modbus cable will be continuously shielded. LonWorks cable must be shielded into and out of VFDs, or any other noise-generating piece of equipment. Ethernet cable, regardless of protocol, must be shielded into and out of VFDs, or any other noise-generating piece of equipment. Input/output (I/O) cable need not be shielded.
- H. Ethernet cable shall comply with the color chart herein and be consistent with Owner IT standards and requirements, and at a minimum IEEE 802.3 Category 6 cable.
- I. Tubing for air pressure sensors shall be polyethylene, approved for plenum installations, have high stress-crack resistance and be resistant to ultraviolet light.

2.13. TRANSFORMERS AND DC POWER SUPPLIES

A. Control Transformers

- 1. Class 2, sized and rated for application. Circuit breaker overcurrent protection; fused or internal overcurrent protection is not allowed. Transformers shall be sized so that connected load does not exceed 75 percent of rating. Functional Devices TR series or approved equal.

B. DC Power Supplies

- 1. Class 2, sized and rated for application. Overcurrent protection with auto-reset; fused or internal overcurrent protection is not allowed. Transformers shall be sized so that connected load does not exceed 75 percent of rating. IDEC PS5R-V Series or approved equal.

2.14. SURGE PROTECTION

- A. Provide any power supply surge protection, filters, etc. as necessary for proper operation and protection of all BAS Components.
- B. All BAS Components shall be capable of handling voltage variations 10% above or below measured nominal value, with no effect on hardware, software, communications, and data storage.
- C. Provide Control Panel surge protection for:
 - 1. Building Controllers and/or their associated Control Panels
 - 2. Control Panels with 11 or more hardwired input/output points entering/exiting the panel.
 - 3. Control Panels with network routers, switches, and/or other network/interface devices.
 - 4. Location(s) required by Owner based on submitted controls architecture.
 - 5. Manufactured by Ditech DTK-120HW or approved equal.

- D. Provide surge protection for DLN and/or BLN at every point network enters or leaves the building enclosure.
 - 1. Manufactured by Ditech DTK-2MHL series or approved equal for copper twisted-pair networks.
 - 2. Manufactured by Ditech DTK-110C6A series or approved equal for ethernet networks.

2.15. SWITCHES

- A. Provide network switches inside Control Panels as required for BLN and/or DLN communications.
- B. Manufactured by Contemporary Controls Skorpion Switch GT Series (1000 GB) or approved equal.

2.16. SOFTWARE

- A. Provide one copy of Manufacturer software for installation on Owner-chosen computer. Coordinate with Owner on processing, memory, operating system, and other computer requirements.
 - 1. Software shall provide complete access to programming, configuration, graphical editing, user management, alarm and trending editing, network management, and any other access required for the entire BAS system architecture (including but not limited to Device Controllers, Building Controllers, Building Supervisor, and/or Enterprise Supervisor, as well as the LAN, BLN, and DLN).
- B. Provide one copy of ALL programming tools for all Device Controllers. Provide multiple versions of Software as required. Software will be fully licensed and not a "partial" or "light/lite" software version. Any functionality the Manufacturer and/or Vendor has available to them will also be provided to the Owner.
- C. Install software on Owner-chosen computer. Coordinate with Owner on processing, memory, operating system, and other computer requirements.

PART 3 - EXECUTION

3.1. EXAMINATION/PREPARATION

- A. Examine areas and conditions under which BAS is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Owner and Contractor. Report any issues to Owner and/or General Contractor.
- B. Beginning of installation means the installer accepts existing conditions.
- C. Coordinate installation of BAS with installation of mechanical systems to complement work of other Division 15 contractors.
- D. These Specifications call out certain duties of Contractor and any subcontractor(s). They are not intended as a material list of all items required by the Project.

3.2. INSTALLATION

- A. Provide related items and work indicated in the Contract Documents, as specified or not specified, necessary to provide a complete and fully functioning BAS, including but not limited to:
 - 1. All incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, supervision, labor, consumable items, fees, licenses, etc.
 - 2. All BAS Components, devices, power supplies, transformers, fittings, sensors, controllers, wiring, accessories, etc.
 - 3. All wiring, including communication network, analog points, digital points, low voltage power, line voltage power, emergency power, etc.

- 4. All associated power and low voltage connections.
 - 5. All conduit, junction boxes, fittings, panels, enclosures, hardware, etc.
 - B. Utilize licensed electricians for all electrical distribution systems.
 - C. The Contract Documents show the general arrangement of the respective systems. Follow as closely as actual building construction and the work of other trades will permit.
 - D. Maintain redlines of shop drawings throughout installation process. Redlines will be used to generate O&Ms, and any other closeout documentation as specified herein. Shop drawings for O&Ms which are submitted unchanged from the Action Submittal phase will be required to be as-built to actual constructed conditions at no cost to Owner.
- 3.3. PRODUCT DELIVERY, STORAGE, HANDLING, PROTECTION, AND CLEANING
- A. All products and materials shall be new, clean, and free of defects, damage, and corrosion.
 - B. Ship and store products and materials in a manner which will protect them from damage, weather, and entry of debris until final acceptance.
 - C. Where BAS Components are required to be factory-mounted on MEP Equipment by others, arrange for shipping of BAS Components to MEP Equipment manufacturer.
- 3.4. SITE CLEAN-UP
- A. At conclusion of each day's work, and at the request of Owner, clean up and remove from the site all rubbish, debris, and trash accumulated during the day as a result of work of Contractor.
 - B. Marks on walls and/or ceiling tiles caused by Contractor shall be cleaned by Contractor.
 - C. Ceiling tiles, drywall, carpet, paint, and all architectural finishes damaged by Contractor shall be replaced by Contractor.
- 3.5. POWER WIRING, CONTROL WIRING, AND CONTROL TUBING
- A. Comply with other sections of Division 15 and Division 16.
 - B. Extend 120V power circuits from points provided to control voltage transformers. Where dedicated junction boxes have been provided, coordinate the exact locations with the Electrical Contractor. Where they have not, coordinate the spare circuit breakers to be used with the Electrical Contractor and/or Owner.
 - C. Install all wiring and tubing in conduit.
 - 1. Exception: Class 2 wiring and tubing may be installed exposed in rated plenum spaces where exposed plenum cable and tubing is appropriate. Install all BAS wiring and tubing in dedicated BAS J-hooks; no wiring or tubing will be run with other low-voltage cables (such as Owner IT cable tray). Tie cables and tubing together and to J-hook (if open style, not required if has built-in fastener).
 - D. Install wire, cable, and accessories with sufficient slack and flexible connections to allow for vibration of piping and equipment.
 - E. Wire safeties and limit controls to prevent operation of MEP Equipment in any selector position (off-hand-auto).
 - F. Provide sleeves and conduit for passage of wiring through structural masonry, concrete walls and floors, and elsewhere for the proper protection of the BAS. Seal as required.
 - G. Splices are not permitted within the BLN or DLN communication cables. Only continuous network topologies or continuous homeruns are allowed for these networks. Splices identified, including damage to cable, will result in cable being re-pulled at no additional cost to Owner.

- H. Limit DLN and BLN cable lengths to no longer than 70% of the longest dimension published by the manufacturer of the cable or Controller, between the most remote network nodes/Controllers.
- I. Shielded wiring will have shields twisted together and taped against jacket of cable. No exposed shields will be allowed. Ground shield at one end of cable.
- J. LonWorks communication network shall transition from unshielded to shielded at device prior to VFD(s), be shielded into and out of the VFD(s), and transition back to unshielded at device after VFD(s).
- K. Power wiring, control wiring, and wiring accessories (i.e. conduit) shall be consistent with color chart herein.
- L. Power wiring, control wiring, and wiring accessories shall comply with Division 16. Where the Specification conflicts with Division 16, Contractor will comply with the most stringent requirement.
- M. Install control transformers and DC power supplies inside Control Panels. Transformers randomly installed in plenum, or connected to junction box via nipple mount, is not allowed.
- N. Install surge protection for wiring as required. Surge protection for 120V shall be installed exterior to Control Panel. Surge protection for communication network will be installed in close proximity to grounding locations and bars. Route communication network such that surge protection can be installed in accordance with manufacturer's instructions. Excessive grounding wiring runs and/or grounding to structural steel for surge protection is not permitted.
- O. Maintain all bend radius requirements with control tubing. Do not kink tubing. Do not use tees, elbows, or other fittings in tubing.
- P. I/O wiring shall be terminated to field BAS Components in accordance with manufacturer instructions and NEC. I/O wiring shall be terminated to BAS Components in Control Panels in accordance with 2.11 Control Panels and Enclosures. I/O wiring between field and Control Panel terminations will be continuous. Splices will be repaired in a permanent fashion (i.e., solder and heat shrink). Wire nuts in the Control Panel or I/O wiring between field and Control Panel terminations are not allowed.
- Q. I/O wiring shall be labeled in accordance with 1.14 Colors and Labeling. Wire number shall correspond to wire number shown on Closeout Documentation.
- R. I/O cabling will be sized in accordance with the load and distance traveled. Input wiring will be minimally 22AWG. Output wiring will be minimally 18AWG.

3.6. NETWORK MANAGEMENT FUNCTIONAL REQUIREMENTS

- A. Contractor shall thoroughly and completely program and configure BAS Components, software, supplemental software, application programming, network communications, operator workstations, computers, printer, and network communications to permit the functional requirements of the BAS herein specified. The setup shall include as a minimum the following network management procedures:
 - 1. Automatic backup of the BAS database to appropriate media.
 - 2. Program, load, and debug all software installations, including integration of third-party applications (i.e., analytics and energy management).
 - 3. Network user auditing routine.

3.7. POINT-TO-POINT TESTING/CHECKOUT

- A. As a part of installation, provide checkout (also called point-to-point testing) of all BAS Components.

- B. Prior to start-up of any MEP Equipment, ensure all points have been properly set up, including but not limited to sensor type and range.
- C. Ensure BAS Component is accessible for maintenance.
- D. Ensure sensors and devices have been installed in the correct location in accordance with actual field conditions and modifications made to the flow diagram in the Contract Documents. Ensure sensors and devices have the proper flow direction, orientation, insertion depth, and any other applicable requirements.
- E. Provide means to increase or decrease sensed value and ensure the BAS responds accordingly.
- F. Checkout will be performed via Owner's final graphic screens. If checkout is performed within the programming function of the BAS, it shall be repeated when the final graphic screens are complete and available for use.
- G. Check operation of valve/damper-actuator combination to confirm that actuator modulates valve/damper smoothly throughout stroke to both open and closed positions. Check valve for proper close off.
- H. Provide documentation of the checkout process for each piece of MEP Equipment.

3.8. START-UP TESTING

- A. At the conclusion of point-to-point testing/checkout, provide start-up testing of all BAS Components.
- B. Provide start-up of all MEP Equipment. Perform start-up in conjunction with any applicable trades.
- C. Provide start-up testing to ensure all configuration and programming conforms with Sequence of Operation.
- D. Start-up testing will be performed via Owner's final graphic screens. If start-up testing is performed within the programming function of the BAS, it shall be repeated when the final graphic screens are complete and available for use.
- E. Tune PIDs to provide reasonable speed response to change in variables while having stable operation.
- F. Provide documentation of the start-up testing process, including any modifications made to the Sequence of Operation, for each piece of MEP Equipment.

3.9. ADJUSTING AND CALIBRATION

- A. Adjust and calibrate all points on the BAS as follows.
- B. Prior to calibration, complete all point-to-point testing/checkout and start-up testing to ensure the BAS is fully functioning.
- C. Calibrated instrument shall be minimally twice as accurate as the sensor's installed accuracy.
- D. Using calibrated instruments, document actual value (per calibrated instrument) and indicated sensor reading (per the BAS). Adjust using a single point offset or a double-point calibration. Document calibration value(s).
- E. If sensor reading is within the manufacturer's stated accuracy, do not calibrate the sensor. Document actual value and sensor reading.
- F. If sensor is greater than manufacturer's stated accuracy, investigate installation of sensor (i.e., 5-10 pipe/duct diameters downstream, etc), programming of sensor (i.e., SVNTs, range, voltage instead of mA and resistance causing high voltage drop, etc.), transient issues (i.e., turbulence, diffuser blowing on sensor). If investigation uncovers potential source of error, correct sensor installation.
- G. If no errors are found and sensor's accuracy is between 100 and 200% of manufacturer's stated accuracy, provide:

1. Single-point offset for sensors whose readings will vary less than 20% (ex., room temperature).
 2. Two-point calibration for sensors whose readings will vary greater than 20%.
 3. Document actual value, sensor reading, and offset/calibration values.
- H. If no errors are found and sensor's accuracy is greater than 200% of manufacturer's stated accuracy, replace sensor. Alternatively, provide documentation for approval as to why sensor's error is more than 200% of manufacturer's stated accuracy.
- I. Work with Testing and Balance (TAB) Contractor to input calibrations performed within TAB Contractor's scope of work. Provide dedicated personnel to assist TAB Contractor during their work, provide a fully functioning TAB graphical screen on the BAS for TAB Contractor use, or provide means to adjust TAB via wall module. Assist TAB Contractor with questions regarding TAB graphical screen.
- J. Do not calibrate any sensor which has a guaranteed installed accuracy, such as airflow monitoring stations (AFMS) or water flow sensors.
- 3.10. FUNCTIONAL PERFORMANCE TESTING (FPT) PROCEDURE**
- A. Perform point-to-point testing/checkout, start-up testing, adjusting/calibration testing, configuration, and programming on all MEP Equipment and the BAS as a whole to provide a complete and fully functioning BAS.
- B. BAS shall be complete and fully functioning prior to any Functional Performance Testing (FPT). Assist Owner and/or Owner Representatives, which may include but is not limited to the Engineer, Architect, Commissioning Agent (CxA), and/or Testing and Balance (TAB) Firm, with FPT, which may include but is not limited to verification, commissioning, and/or Graphical User Interface (GUI) acceptance testing. Provide dedicated personnel to those activities as specified herein or as requested by Owner.
- C. Provide documentation as specified to prove the BAS is complete and fully functional prior to FPT activities.
- D. At a minimum, perform the following FPT procedures. The following may be achieved within a Commissioning Plan or another FPT as required within the Contract Documents.
1. Provide Owner an agenda and schedule of FPT activities for approval and coordination as part of Action Submittals.
 2. Complete all necessary installation to have a complete and fully functional BAS. Provide written notice that BAS is ready for FPT.
 3. Demonstrate BAS systems to Owner. Perform FPT including but not limited to Sequence of Operation, point-to-point verification to graphical interface, historical data logging, and alarms.
 4. Owner to provide detailed punch list to Contractor.
 5. Contractor to repair issues on Owner punch list within five business days.
- 3.11. CLOSEOUT**
- A. Upon completion of Functional Performance Testing (FPT), Contractor provides all requirements as specified in 1.12 Close-Out Submittals to Owner.
- B. Contractor trains Owner on all aspects of the BAS including architecture, devices, software, and final Sequences of Operation.
- C. Owner issues letter to Contractor declaring that system is Substantially Complete. Date of this letter starts the Warranty Period.
- D. Final Acceptance. Owner issues letter to Contractor accepting system. Final pay app can be issued for release of any remaining contingency funds.

3.12. WARRANTY AND MAINTENANCE

- A. Provide warranty and service of BAS for duration of Warranty Period.
- B. Correct any issues, including physical issues such as failure of BAS components, as well as software and/or programming issues that are discovered during the Warranty Period.
- C. Provide documentation of corrections in the form of service call records.
- D. Update all closeout documentation, including software backups, to Owner for any changes.

3.13. CONTROL PANELS

- A. Install Control Panels at locations in accordance with the Contract Documents and/or Owner. Ensure proper service clearances will be achieved at the end of construction. Control Panels without proper service clearances will be relocated at no cost to Owner.
- B. For any Control Panel that exceeds 16 inches in any dimension, provide a trough above/below Control Panel. Trough shall be separated into high and low voltage. Provide a high and low voltage conduit or nipple between trough and Control Panel, sized appropriately for the high and low voltage wiring. All other conduit that serves the Control Panel shall enter/exit the trough. Do not terminate any other conduit(s) to the Control Panel outside of two conduits/nipples identified.
- C. Provide a service loop for all controls wiring. Service loop will be installed in trough (where provided) or inside Control Panel cable tray (where allowed).
- D. Contractor shall extend power to the Control Panel from a junction box or an acceptable location (coordinate with Owner and/or Division 16).

3.14. GRAPHICS/OPERATOR INTERFACE

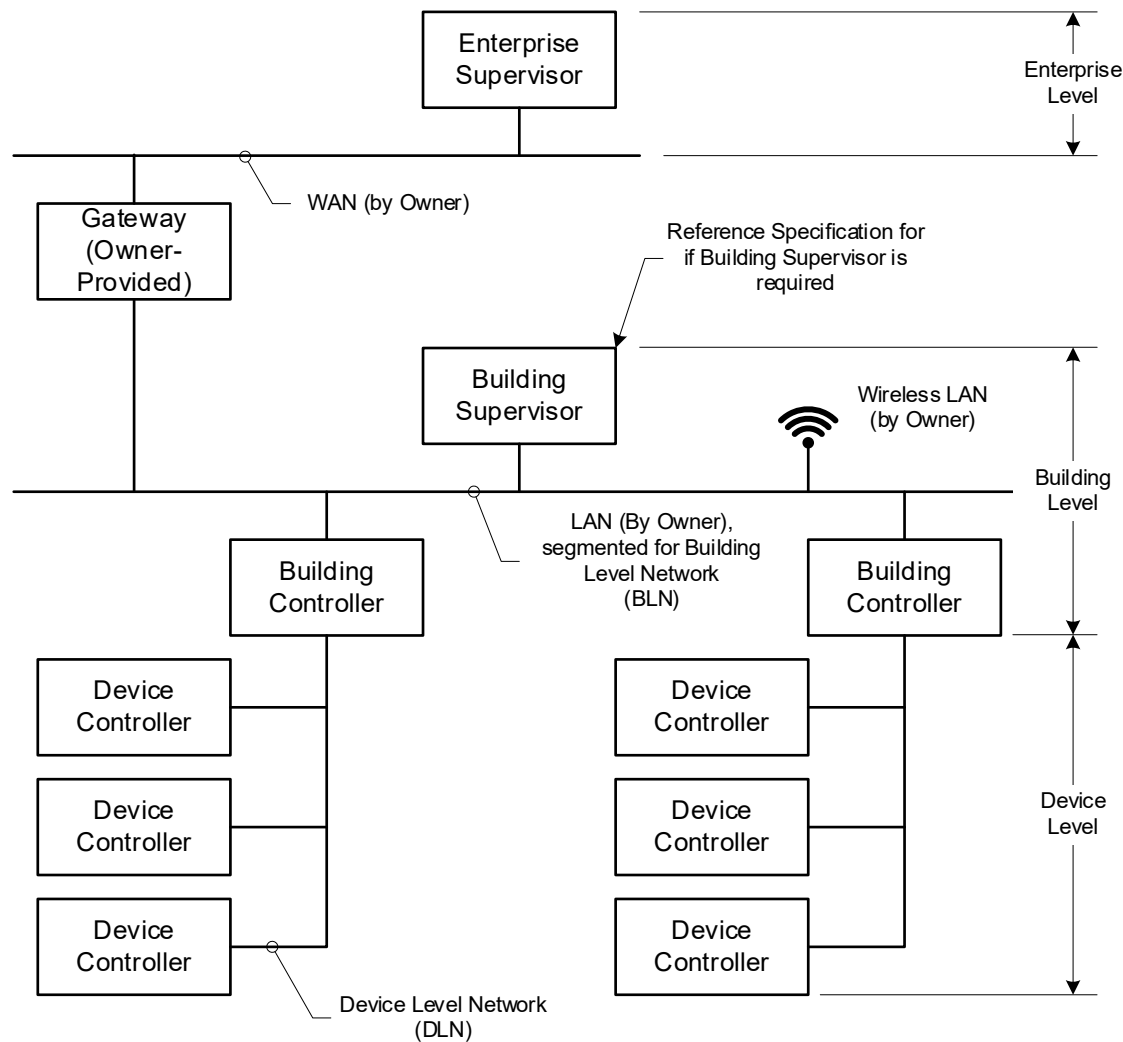
- A. The graphics shall comply with the Owner's requirements and/or Master Plan.

3.15. RETROFIT WORK, ADDITIONAL REQUIREMENTS

- A. Control Panels
 - 1. Where existing enclosures are to be reused, provide UL508A "Open" certification, where required, per 2.11 Control Panels and Enclosures.
 - 2. Where existing enclosures are to be reused, provide Control Panel design which facilitates the reuse of wiring without needed to be extended (ex: install terminal blocks across top of Control Panel backplate to allow for minimal need for extending wiring).
 - 3. Where wiring must be extended to reach, wiring will be spliced in a permanent fashion (i.e., solder and heat shrink). Wire nuts in the Control Panel are not allowed.
 - 4. Where the existing Control Panel does not facilitate an installation that otherwise would require excessive extending of wire, the existing enclosure can be used as a "patch panel" via terminal blocks.
- B. General
 - 1. Damaged wire, splices from previous work, or any other rework required will be performed as part of the base bid.

PART 4 - FIGURES

4.1. NETWORK DIAGRAM



PART 5 - BAS MASTER PLAN

5.1. INCLUDED AS ATTACHMENT HEREIN.

END OF 15900 BUILDING AUTOMATION SYSTEMS

15910 BAS SENSORS AND DEVICES

PART 1 - GENERAL

1.1. APPLICABLE SECTIONS

- A. 15900 Building Automation Systems

PART 2 - PRODUCTS

2.1. GENERAL

- A. Provide BAS Components as indicated in the Contract Documents, Sequence of Operation, control diagrams, points lists, Specifications, or as needed to perform the intended operations consistent with the design intent of the BAS and design/performance intent of the MEP Equipment.
- B. Provide with metal enclosure for all plenum applications. Any sensor mounted in plenum that has a plastic enclosure will be rated for plenum installation or installed in a plenum-rated enclosure.
- C. All sensors shall be vibration and corrosion resistant.
- D. Accuracy statements are written for the specific sensor. Installation shall not degrade accuracy more than double what accuracy statement for sensor requires.
- E. Enclosures:
 - 1. Provide suitable enclosure for BAS Component for ambient conditions encountered by application.
 - 2. NEMA Type 1 or 2 for indoor and protected applications.
 - 3. NEMA Type 3R, 4 or 4X for outdoor and unprotected applications.

2.2. TEMPERATURE SENSORS, STANDARD ACCURACY

- A. Manufacturers:
 - 1. ABB
 - 2. ACI
 - 3. BAPI
 - 4. Distech
 - 5. Honeywell
- B. General Requirements:
 - 1. Sensor shall be thermistor or RTD inherently compatible with BMS.
 - 2. Accuracy: ± 0.5 deg F over 32 to 158 deg F range.
 - 3. Operating Temperature Range: -40 to 300 deg F.
- C. Outside Air Temperature (OAT) Sensor: Sensor installed in wall-mounted weatherproof enclosure with conduit entrance, with PVC sun and windscreen as required.
- D. Duct-Mounted Single-Point Temperature Sensor: Rigid sensor sealed in 0.25-inch stainless steel probe of length between one-third and two-thirds of the duct width in duct-mounted metal housing with conduit entrance.
- E. Duct-Mounted Averaging Element Temperature Sensor: Multi-point sensor, contained in a flexible copper or woven continuous metallic sheath, with length sized for duct.
 - 1. Provide a minimum of 1 foot of sensing element for every three square feet of duct/coil area. Multiple averaging elements may be required.

2. Averaging elements shall be used where ducts are prone to stratification, and downstream of heating/cooling coils.
 3. Where multiple sensors are provided, sensors may be wired in a series-series, parallel-parallel pattern (requires four or nine sensors) in lieu of multiple inputs.
 4. Plenum rated sheaths are not acceptable.
- F. Wall-Mounted Flat-Plate Temperature Sensor: Stainless steel, flat plate sensor that fits in a standard 2-inch by 4-inch junction box with tamperproof screws. Provide with insulated back.
 - G. Thermowell-Mounted Immersion Temperature Sensor: Rigid sensor sealed in 0.25-inch stainless steel probe, with three-part moisture protection system, that has minimum length of 20% of the pipe width. Provide machined, single-piece brass or stainless steel thermowell compatible with sensor housing.
 - H. Strap-On Piping Temperature Sensor: Sensor with metal clamps to fasten to piping. Strap-on sensors are only acceptable where specifically called for in Contract Documents. Thermowell and insertion sensor shall be installed where strap-on temperature sensor not specifically called for.
 - I. Cooler/Freezer Temperature Sensor: Use bullet probe style sensor.
- 2.3. TEMPERATURE SENSORS, MATCHED PAIR
- A. Where two temperature sensors will be used together to calculate a BTU measurement, provide a matched pair.
 - B. General Requirements
 1. All requirements for Standard Accuracy Temperature Sensors are applicable, except where more stringent below.
 2. Sensor shall be thermistor or RTD with matched transmitter, bath calibrated, 4-20mA output proportional to temperature range and compatible with BAS and 24 Vac/dc power supply.
 3. Differential Accuracy: ± 0.15 deg F at 70 deg F.
 4. Measurement Range: 32 to 200 deg F.
 5. Range of sensor output shall be appropriate for the application the sensor is installed in. Range of the output shall be set at the factory and shown on the provided documentation.
- 2.4. HUMIDITY SENSORS, STANDARD ACCURACY
- A. Manufacturers
 1. ABB
 2. ACI
 3. BAPI
 4. Distech
 5. Honeywell
 - B. General Requirements:
 1. Laser-trimmed thermoset polymer-based capacitive-type sensor, 4-20mA or 0-10Vdc output proportional to relative humidity range of 0% to 100% and 24 Vac/dc power supply.
 2. Accuracy: ± 2 percent over 10 to 90 percent range.
 3. Measurement Range: 0-100%.
 4. Operating Temperature Range: -40 to 140 deg F.
 - C. Outside Air Relative Humidity (OAH) Sensor: Sensor installed in wall-mounted weatherproof enclosure with conduit entrance, with PVC sun and windscreen as required.

- D. Duct-Mounted Relative Humidity Sensor: Sensor in duct-mounted plenum-rated housing with conduit entrance.
- E. Wall-Mounted Relative Humidity Sensor: Sensor in white plastic enclosure with insulated back.

2.5. COMBINATION RELATIVE HUMIDITY AND TEMPERATURE SENSORS

- A. Where there is a requirement for the monitoring of both relative humidity and temperature at the same location, provide combination relative humidity and temperature sensors. The individual sensors must each meet the specifications details herein.
- B. Where required in the drawings, combination relative and humidity sensors shall have the ability to output additional parameters, including dew point, enthalpy, and wet bulb temperature.

2.6. WALL MODULES AND ROOM SENSORS, STANDARD ACCURACY

- A. General
 - 1. Wall modules and room sensors cover devices which mount on a wall and provide an interface between the MEP Equipment and the occupant.
- B. Manufacturers: Provide a wall module consistent with the manufacturer providing the overall controls.
- C. General Requirements:
 - 1. Wall modules which measure including but not limited to temperature, relative humidity, and/or carbon dioxide must each meet the specifications details herein.
 - 2. Provide with plastic enclosure with display, override switch, override indicator, and setpoint adjustment.

2.7. DRY (AIR) PRESSURE SWITCH

- A. Manufacturers
 - 1. Dwyer
 - 2. Cleveland Controls
- B. General Requirements
 - 1. Diaphragm pressure switch with SPDT contacts.
 - 2. Sensor shall be uni-directional.
 - 3. Manual or automatic reset, in accordance with Contract Documents.
 - 4. Setpoint adjustment knob.
 - 5. Accuracy: ± 2 percent of full scale output.
 - 6. Measurement Range: 0 to 12 in wg.
 - 7. Operating Temperature Range: -4 to 185 deg F.
- C. "Paddle-style" air flow switches are not allowed. Use dry pressure switch in lieu of paddle.

2.8. DRY (AIR) PRESSURE SENSOR, STANDARD ACCURACY

- A. Manufacturers
 - 1. ACI
 - 2. Honeywell
 - 3. Setra
 - 4. Veris
 - 5. ABB
- B. General Requirements

1. Diaphragm pressure transducer and amplifier type sensor, 4-20mA or 0-10Vdc output proportional to pressure range and compatible with BMS system and 24 Vac/dc power supply.
 2. Sensor shall be uni- or bi-directional for application as stated below.
 3. Sensor shall have local display.
 4. Accuracy: ± 1 percent of full-scale output/selected range.
 5. Measurement Range: See applications below.
 6. Operating Temperature Range: -4 to 140 deg F.
 7. Burst pressure: 5 psid.
- C. Duct-Mounted Static Pressure Sensors:
1. Uni-directional.
 2. Measurement Range: 0 to 5 in wg. for low and medium pressure applications and higher as required for high pressure applications.
- D. Room Pressure Sensors:
1. Bi-directional.
 2. Measurement Range: -0.2 to 0.2 in wg.
 3. Provide with surge damper (Amphenol SD-01 or equivalent) and room static pressure pickup with fine stainless steel mesh filter.
- E. Building Pressure Sensors:
1. Bi-directional.
 2. Measurement Range: -0.2 to 0.2 in wg.
 3. Provide outside air reference kit, (Dwyer A-306 or equivalent), with tubing, mounting bracket and required hardware.
 4. Provide with surge damper (Amphenol SD-01 or equivalent) and room static pressure pickup with fine stainless steel mesh filter.
- F. Air Filter/Coil Differential Pressure Sensors:
1. Uni-directional.
 2. Measurement Range: 0 to 2 in wg and higher as required.
 3. Provide with static pressure probe(s).
- 2.9. WET (WATER) PRESSURE SWITCH
- A. Manufacturers
1. Ashcroft
- B. General Requirements
1. Diaphragm pressure switch with SPDT contacts.
 2. Sensor shall have stainless steel wetted components in a weatherproof wiring housing.
 3. Sensor shall be uni-directional.
 4. Manual or automatic reset, in accordance with drawings.
 5. Setpoint adjustment knob.
 6. Accuracy: ± 2 percent of full scale output.
 7. Measurement Range: 0 to two times the setpoint or anticipated pressure.
 8. Operating Temperature Range: -20 to 150 deg F.
- C. "Paddle-style" water flow switches are not allowed. Use wet pressure switch in lieu of paddle.

2.10. WET (WATER) PRESSURE SENSOR

A. Manufacturers

1. Senva
2. Setra
3. Veris
4. ABB

B. General Requirements

1. Diaphragm pressure transducer and amplifier type sensor, 4-20mA or 0-10Vdc output proportional to pressure range and 24 Vac/dc power supply.
2. Sensor shall have stainless steel wetted components in a weatherproof wiring housing.
3. Sensor shall be uni-directional, unless bi-directional required for reversing flow.
4. Sensor shall have local display.
5. Accuracy: ± 0.25 percent of full-scale output/selected range.
6. Measurement Range: See applications below.
7. Operating Temperature Range: See applications below.
8. Proof Pressure: two times rated input pressure, or greater.
9. Burst Pressure: five times rated input pressure, or greater.

C. Water "Gauge" Pressure Sensors:

1. Measurement Range: 0 to two times the setpoint or anticipated pressure.
2. Operating Temperature Range: 0 to 175 deg F.

D. Water Differential Pressure Sensors:

1. Measurement Range: 0 to two times the setpoint or anticipated pressure.
2. Operating Temperature Range: 0 to 175 deg F.

E. Provide with four or five valve manifold. Sensor to be connected to manifold at factory.

2.11. CURRENT SWITCHES/TRANSDUCERS

A. Manufacturers

1. ACI
2. Setra
3. Veris
4. ABB

B. General Requirements

1. Sensor shall be rated for their associated motor load and voltage, have input and output isolation, and have LED indication of status.
2. Sensor shall be selected based on application, including but not limited to standard 60 hertz motors, variable speed drive, or ECM.
3. Accuracy: ± 2 percent of full-scale output.
4. Measurement Range: 0 to two times the anticipated current.
5. Operating Temperature Range: 5 to 140 deg F.

C. Current Switch (CS):

1. Self-powered current switch with N.O. contacts.
2. Provide with adjustable trip point where indicated in Contract Documents, or as required for proper operation for application.

D. Current Transducer (CT):

1. Sensor with 4-20mA or 0-10Vdc output proportional to current draw and 24Vac/dc power supply.

2.12. CARBON DIOXIDE SENSORS

A. Manufacturers

1. Honeywell
2. Vaisala
3. Veris
4. ABB

B. General Requirements

1. Non-dispersion infrared (NDIR) type sensor, 4-20mA or 0-10Vdc output proportional to carbon dioxide (CO₂) range and 24 Vac/dc power supply.
2. Sensor shall have local display.
3. Accuracy: ± 2 percent of reading, or 30 ppm, whichever higher.
4. Measurement Range: 0 to 2000 ppm.
5. Operating Temperature Range: 32 to 122 deg F.
6. Standard Calibration: No maintenance or periodic sensor replacement needed. The sensor shall have a 5-year calibration interval, utilizing an automatic unoccupied period calibration.

C. Wall-Mount Carbon Dioxide Sensors: Sensor with plastic enclosure that fits on a standard 2-inch by 4-inch junction box.

D. Duct-Mount Carbon Dioxide Sensors: Sensor with sampling tube, duct-mounted metal housing with conduit entrance.

E. Where CO₂ is provided beside temperature and/or humidity sensors, it shall be provided separately and not combined into a single sensor.

2.13. AIRFLOW MEASUREMENT STATION (AFMS)

A. Manufacturers

1. Ebtron

B. General Requirements

1. Thermal dispersion type flow sensor, composed of one or more sensor probes (multiple sensors per probe) and transmitter, 4-20mA or 0-10Vdc output proportional to flow range and 24 Vac/dc power supply.
2. Measurement will be made using the principle of thermal dispersion. Provide one self-heated bead-in-glass thermistor and one zero power bead-in-glass thermistor at each sensing node. Thermal dispersion devices that indirectly heat a thermistor are not acceptable. Other measurement technologies are not acceptable.
3. Sensor probe tubes and mounting brackets shall be constructed of gold anodized, 6063 aluminum alloy, 304 stainless steel, or 316 stainless steel.
4. Internal wiring in probes shall be resilient to exposure of moisture and not effect sensor operation.
5. Sensor probe shall be comprised of multiple sensors, with calibration data stored in the cable connecting plug, such that switching transmitters will automatically read corresponding calibration and sensor data. Quantity of sensors per probe and quantity of probes shall vary based on duct/fan configuration to provide the required accuracy.
6. Accuracy: ± 3 percent of reading over full scale, when installed in accordance with manufacturer guidelines. ± 5 percent of reading over full scale for outdoor air intakes,

when installed in accordance with manufacturer guidelines. Accuracy is for installed air flow monitoring sensor, not for individual sensors in each probe.

7. Measurement Range: 0 to 5,000 feet per minute (fpm).
8. Operating Temperature Range: Probes: -20 to 160 deg F. Transmitter: -20 to 120 deg F.
9. Sensing elements will be NIST traceable.
10. Transmitter:
 - a. Heavy-duty construction with LED display with 4-20mA air flow and temperature output signals. Outputs may be field configured for additional signals.
 - b. Capable of communicating with BAS on communication protocol as specified in 15900
 - c. Transmitter shall generate alarms for individual sensor errors and transmit over the BMS network.
 - d. Transmitter will be provided with Bluetooth low-energy interface card, capable of transmitting information to Android or iOS devices.
- C. Duct Air Flow Measuring Stations: Probes will be ordered specific to duct as installed in field.
- D. Fan Inlet Air Flow Measuring Stations: The sensing element shall be specifically designed to measure air flow of a centrifugal fan at the inlet cone. Coordinate mounting style with fan selection and manufacturer recommendations. For double-inlet fans, provide one set of elements for each inlet.

2.14. INSERTION TURBINE WATER FLOW METERS

- A. Manufacturers
 1. Onicon F-1000 series
- B. General
 1. Provide with NIST traceable, wet calibrated flow-measuring element, integral transmitter (4-20mA or 0-10Vdc output proportional to flow range), installation valves, depth gage, calibration certificate, and attached tag indicating calibration information.
 2. Flow meter shall be wet tappable, allowing insertion and removal from the flow stream without system shutdown.
 3. Provide power from 24 Vac/dc power supply.
 4. Contractor shall be responsible for selecting flow meter options submitted based on application. Flow meter shall be constructed, calibrated, and scaled for the intended application in terms of pipe size, pipe material, installation requirements, expected flow rate, ambient conditions, and fluid characteristics which include but are not limited to pressure, temperature, conductivity, and viscosity.
 5. Single or dual axial insertion turbine design with electronic impedance-based sensing circuit. Dual insertion turbine shall incorporate two contra rotating turbines and an averaging circuit to reduce measurement errors due to flow distortions, such as swirl, when installed in piping configurations with reduced straight run.
 - a. Coordinate single or dual turbine requirements with as-built conditions to ensure accuracy is achieved as specified.
 6. 316L stainless steel construction.
 7. Maximum pressure rating: 400 psig or greater.
 8. Maximum temperature rating: 280°F or greater.
 9. Accuracy: ± 2 percent of reading from 0.4 to 20 fps, when installed in accordance with manufacturer guidelines.
 10. Flow range: 0 to 20 fps

11. Provide with installation kit appropriate for application.

C. Application

1. Chilled water, chilled glycol, hot water, or any other media which contains minimal particulate.

2.15. INSERTION ELECTROMAGNETIC WATER FLOW METERS

A. Manufacturers

1. Onicon F-3500 Series

B. General

1. Provide with NIST traceable, wet calibrated flow-measuring element, integral transmitter (4-20mA or 0-10Vdc output proportional to flow range), installation valves, depth gage, calibration certificate, and attached tag indicating calibration information.
2. Flow meter shall be wet tappable, allowing insertion and removal from the flow stream without system shutdown.
3. Provide power from 24 Vac/dc power supply.
4. Contractor shall be responsible for selecting flow meter options submitted based on application. Flow meter shall be constructed, calibrated, and scaled for the intended application in terms of pipe size, pipe material, installation requirements, expected flow rate, ambient conditions, and fluid characteristics which include but are not limited to pressure, temperature, conductivity, and viscosity.
5. Electromagnetic sensing element shall utilize two sets of diametrically opposed electrodes to measure the average flow rate velocity.
6. 316L stainless steel construction.
7. Maximum pressure rating: 400 psig or greater.
8. Maximum temperature rating: 200°F or greater.
9. Accuracy: ± 1 percent of reading from 2 to 20 fps, when installed in accordance with manufacturer guidelines.
10. Flow range: 0 to 20 fps
11. Provide with installation kit appropriate for application.

C. Application

1. Condenser water or any other media which contains particulate.

2.16. BTU (ENERGY) METERS

A. Manufacturers

1. Onicon System 10

B. General

1. Water flow meter, dual temperature sensors, and transmitter, 4-20mA or 0-10Vdc output proportional to flow range and each temperature (3 analog outputs total), and 24 Vac/dc power supply.
2. Provide water flow meter in accordance with the specification herein.
3. Provide matched temperature sensors in accordance with the specification herein.
4. Transmitter
 - a. Provide with local display and operator interface. Display shall visually indicate instantaneous flow rate, supply temperature, return temperature, thermal energy flow rate (MBH).
 - b. Capable of communicating with BAS on communication protocol as specified in 15900

2.17. THERMOSTATS

A. Manufacturers

1. ACI
2. Honeywell
3. ABB
4. Schneider Electric

B. General

1. Label switches "FAN ON-OFF", "FAN HIGH-LOW-OFF", "FAN HIGH-MED-LOW-OFF", or as applicable.
2. Mount on standard junction box.
3. Thermostat portion must meet the specifications details herein as required for application.

C. Digital Stand-Alone Thermostat

1. Electronic, solid-state, microcomputer-based room thermostat.
2. Automatic switching from heating to cooling.
3. PID control to minimize overshoot and deviation from setpoint.
4. Set up for four separate temperatures/periods per day, with individual programming for each day of the week (4 programs per day, 7 days per week, 28 potential programs).
5. Instant override of setpoint for continuous or timed period from 1 hour to 31 days.
6. Short-cycle protection.
7. Selection features include degree F or degree C display, 12- or 24-hour clock, keypad disable, and fan on-auto-circulate.
8. Powered off unit 24Vac transformer, with solid-state memory in which programming is retained on power failure. Battery acceptable only for time and date upkeep during power failure.
9. Thermostat display features include the following: time of day, actual room temperature, programmed temperature, programmed time, duration of timed override, day of week, and system mode indications include "heating," "cooling," "off," "fan auto," "fan circulate," and "fan on."
10. Combination Thermostat, Humidistat, Carbon Dioxide, and/or Occupancy Sensor: Where there is a requirement for a thermostat with humidistat, carbon dioxide, and/or occupancy sensing functions at the same location, provide combination unit. The individual sensors must each meet the specifications details herein.
11. Provide remote sensing element (electronic sensor) as required for application.

D. Low-Voltage, On-Off Thermostats

1. 24Vac, bimetal-operated, mercury-free, heat anticipator, concealed set-point adjustment, space temperature indicator, 55 to 85 deg F setpoint range, and 2 deg F maximum differential.
2. Selector Switch: Integral, manual on-off-auto.

E. Line-Voltage, On-Off Thermostats

1. Line voltage listed for electrical rating, bimetal-operated, mercury-free, open contact or bellows-actuated, snap-switch or equivalent solid-state type, heat anticipator, concealed set-point adjustment, space temperature indicator, 55 to 85 deg F setpoint range, and 2 deg F maximum differential.
2. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.

3. Selector Switch: Integral, manual on-off-auto.
4. Combination Thermostat and Fan Switches: Push-button or lever-operated fan switch.
- F. Freezestat/Low-Limit Duct Thermostat (LTD)
 1. Manual reset switch.
 2. Snap-acting SPDT with gas/refrigerant filled copper capillary that trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint. Sensing range 15 to 55 deg F.
 3. Bulb Length: Sized for duct/coil with minimum 5 feet.
 4. Quantity: Provide a minimum of 1 foot of sensing element for each square foot of duct/coil area. Multiple Low-Limit Thermostats may be required.
- G. High-Limit Humidistat
 1. Snap acting SPDT, duct or room mount, automatic reset switch that trips if humidity sensed is equal to or above setpoint. Sensing range 15 to 95% relative humidity.
- H. Strap-On Piping Aquastat Temperature Sensor
 1. Snap acting SPDT, pipe mount, automatic or manual reset switch (as indicated in Contract Documents) that trips if temperature sensed is equal to or above setpoint. Sensing range appropriate for application.

2.18. RELAYS

- A. Manufacturers
 1. IDEC
 2. Functional Devices
 3. Veris
 4. ABB
- B. General Requirements
 1. Electrically rated for application, minimally SPDT with 10A (resistive) contacts.
 2. Provide with LED indicator light.
 3. Provide with hand-off-auto (HOA) unless otherwise specified. HOA not required if controller has internal HOA or output being controlled has HOA (i.e. VFD).
 4. Plenum rated where required.
- C. BAS Panel-Mounted Relays: "ice-cube" / socket style with mounting base and replaceable relay. Relays in panel will be screw terminal terminations; relays with wiring whip from factory are not allowed for panel mounting.
- D. Nipple-Mounted Relays: enclosed relay compatible with conduit knockout. Acceptable for field use. With or without factory-provided wiring whip.
- E. Track-Mounted Relays: acceptable for use in terminal unit control panels. Screw terminal terminations. Track-mounted relays are not to be installed in field unless inside an equipment control panel (i.e., no track-mounted relays in electrical boxes).
- F. Combination Motor Starter / Current Switch Relays: allowed only for single-phase equipment and must be mounted such that pilot light is exposed (i.e., combination motor starter / current switch relays which install inside of motor starter/VFDs are not allowed). The individual sensors must each meet the specifications details herein.

2.19. ADDITIONAL SENSORS AND DEVICES

- A. Shaft-Mounted Limit Switches: SPDT/DPDT mercury-free, gravity-actuated mechanical switch with adjustable shaft connection.
- B. Whisker Limit Switches: SPDT/DPDT mechanical whisker switch with adjustable trim arm.

- C. Condensate Drain Pan Overflow Safety Switch: Low-voltage, float-type safety switch designed for condensate drain pan high-level alarm for unit shutdown and alarming. Little Giant Pump/Franklin Electric (ACS series) or equal. Whisker switch with foam float is not acceptable.
- D. Water Leak Detection Alarm: Adjustable-height multi-point water detection sensor constructed to be corrosion and abrasion resistant and configured for normally open or normally closed as required by the application with 24Vac/dc power supply. Provide remote-mounted sensing probe and cable as needed for each application. Operating Temperature Range: -40 to +185 deg F.
- E. Emergency Stop Buttons: ADA-compliant, red emergency pushbutton in yellow polycarbonate plastic enclosure with clear flip-up cover and stainless steel backplate. Button shall be reset by twisting or pulling out the button; a procedure that requires disassembly or a key is not acceptable. 120V or 24 V as needed. Provide label with indication of operation (ex. "Boiler E-Stop"). Safety Technology International (STI) Stopper Station series or equal.

2.20. ELECTRONIC ACTUATORS

- A. Manufacturers: All valve actuators shall be supplied from a single manufacturer. All damper actuators shall be supplied from a single manufacturer. Provide actuators manufactured by one of the following:
 - 1. Belimo
 - 2. Honeywell
 - 3. ABB
 - 4. Schneider Electric (TAC Dura-Drive)
- B. General
 - 1. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
 - 2. Actuators shall operate related valve(s)/damper(s) with sufficient reserve power to provide smooth modulating action or two-position action and proper speed of response at velocity and pressure conditions to which the valve/damper is subjected.
 - 3. Actuators shall produce sufficient power and torque to close off against the maximum system pressures encountered. Actuators shall be sized to close off against the designed pump/fan shutoff pressure as a minimum requirement.
 - 4. Select actuators to fail in desired position in the event of a power failure. See Contract Documents for power failure modes.
 - 5. Provide a position indicator and graduated scale on each actuator indicating open and closed travel limits.
 - 6. Type: Motor operated, with gears, electric and electronic.
 - 7. Voltage: 24Vac unless otherwise specified. 120V actuators may be allowed if coordinated by BAS Contractor with Electrical Contractor to provide local disconnect and power. Circuit must be fed from the same power panel as the MEP Equipment or Control Panel and a spare circuit must be available.
 - 8. Power: Contractor is responsible for sizing control transformers based on the VA of the actuator(s) selected.
 - 9. Provide electronic overload protection throughout the entire operating range in both directions.
 - 10. Coupling: V-bolt and V-shaped, toothed cradle. Bolt and set screw method of attachment is unacceptable.
 - 11. Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.

12. Two-Position Actuators: Single direction, spring return or non-spring return type.
13. Modulating Actuators:
 - a. Capable of stopping at all points across full range and starting in either direction from any point in range.
 - b. Control Input Signal:
 - A) Three Point, Tristate, or Floating Point: Clockwise and counter-clockwise inputs. One input drives actuator to open position, and other input drives actuator to close position. No signal of either input, the actuator remains in the last position.
 - B) Proportional: Actuator drives proportional to input signal and modulates throughout its angle of rotation. Suitable for 0-5Vdc, 0-10Vdc, 1-5Vdc, 2-10Vdc, and 4-20mA signals.
 - c. Floating control actuators shall be allowed only for damper and valve control for room terminal units where there is not a room pressurization requirement. See General Requirements for definition of those spaces. Use of floating controls must be specifically requested by Contractor for specific spaces and reviewed by Owner. Submission of floating control actuators without specific comment by Contractor for spaces and the resulting review by Owner does not constitute approval for use.
 - d. Pulse width modulation (PWM), or any other analog signal that is not specified above is not allowed.
14. Position Feedback: Where indicated, equip two-position actuators with auxiliary switches (SPDT) for remote monitoring of open and/or closed position. Point of open and/or closed position can be adjusted over the actuators range of operation (0-100%). Where indicated, equip modulating actuators with a position feedback through current and/or voltage signal for remote monitoring.
15. Fail-Safe: Where indicated, provide actuator to fail via a mechanical spring return mechanism, to drive controlled device to an end position (open or close) on loss of power. Electronic fail-safe is not allowed, unless specifically reviewed and accepted by Owner. Provide external, manual gear release on non-spring return actuators.
16. Temperature Rating:
 - a. Standard Dampers and Valves: -22 to +122 deg F.
 - b. Smoke Dampers: -22 to +250 deg F.
17. Provide actuator enclosure with a heater and thermostat where required by application.
18. Stroke Time:
 - a. Normal: 120 seconds or less from fully closed to fully open, or fully open to fully closed.
 - b. Fast-Acting: 12 seconds open, 5 seconds closed unless otherwise noted.
- C. Damper Actuators
 1. The total damper area operated by an actuator shall not exceed 80 percent of damper manufacturer's maximum area rating.
 2. Provide one actuator for each damper assembly where possible. Multiple actuators required to drive a single damper assembly shall operate in unison off a single control signal.
 3. Avoid the use of excessively oversized actuators which could overdrive and cause linkage failure when the damper blade has reached either its full open or closed position.
 4. Use shaft couplings in lieu of blade-to-blade linkages when driving axially aligned damper sections.

5. Actuator will mount directly to damper with coupler as described above. No foot mount kits, jackshafts, or linkages shall be used.
6. Sizing: Size for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sqft. of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sqft. of damper.
 - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sqft. of damper.
 - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sqft. of damper.
 - e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1,000 to 2,500 fpm: Increase running torque by 1.5.
 - f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2,500 to 3,000 fpm: Increase running torque by 2.0.
- D. Smoke and Combination Fire/Smoke Damper Actuators
 1. Actuator shall come connected to damper as a rated assembly, sized per the damper manufacturer's requirements, and meet the specifications herein.
 2. Actuators operating in smoke control systems shall comply with governing code and NFPA requirements.
- E. Valve Actuators
 1. Valve actuators will be direct coupled "rotary-style" unless otherwise specified. Where required, direct coupled "linear-style" actuators may be used.
 2. Sizing
 - a. Hydronic: Size for torque required to achieve valve close off at 150% of maximum pump differential pressure.
 - b. Steam: Size for torque required to achieve valve close off at 150% of steam design pressure.

2.21. CONTROL VALVES

- A. General
 1. Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
 2. Control valves assemblies shall be provided and delivered from a single manufacturer as a complete assembly, with the actuator installed at the factory.
 3. Control valves shall be two- or three-way as specified in Contract Documents.
 4. Provide with extended neck as required to accommodate insulation thicknesses.
 5. Refer to Division 15 for general information about valve construction and installation.
- B. Hydronic Ball-Style Control Valves
 1. Manufacturers
 - a. Belimo (CCV Series)
 - b. Honeywell (VB Series)
 2. Construction
 - a. 2-Inch NPS and Smaller: 350 psi at 250 deg F brass/bronze body, stainless steel ball with matching blow-out proof stem, full port with stainless steel or composite characterizing insert, Teflon seats, dual EPDM O-ring seals, solder or threaded ends.
 - b. 2 1/2-Inch NPS and Larger: 175 psi at 250 deg F iron body, stainless steel ball and matching blow-out proof stem, full port with stainless steel or composite characterizing insert, Teflon seats, dual EPDM O-ring seals, ANSI Class 125/150 flanged ends.

- c. ANSI class IV seat leakage for two-way, ANSI class IV seal leakage for three-way A-Port and class III for B-Port.
- 3. Flow Characteristics
 - a. Two-way two-position valves shall be full port.
 - b. Two-way modulating valves shall have equal percentage characteristics.
 - c. Three-way valves shall have equal percentage characteristics on A-Port and linear characteristics for B-Port. Bypass applications shall have linear percentage characteristics.
- 4. Sizing
 - a. Two Position: Line size or size using a 1 psig pressure differential.
 - b. Two-Way Modulating: Size using 4 psig or equal to the load pressure drop, whichever is greater.
 - c. Three-Way Modulating: Size using 4 psig or equal to the load pressure drop, whichever is smaller.
 - d. Effective Cv: for any valve smaller than line size, the pressure drop due to the reduction in pipe size shall be taken into effect. Provide effective Cv on submittal.
- C. Hydronic Butterfly-Style Control Valves
 - 1. Manufacturers
 - a. Belimo (HD Series)
 - b. Honeywell (VFF Series)
 - 2. Construction
 - a. 2 to 12-Inch NPS: Class 125/150 cast-iron full-lugged body, stainless steel disc, EPDM seat and extended neck. Disc-to-stem connection shall utilize an internal spline.
 - b. 14-Inch NPS and Larger: Class 125/150 cast-iron full-lugged body, stainless steel disc, EPDM seat and extended neck. Disc-to-stem connection shall utilize a dual-pin method.
 - c. Leakage: 200 psid zero leakage for 2 to 12-inch NPS and 150 psid zero leakage for 14-inch NPS and larger.
 - 3. Sizing
 - a. Two Position: Line size or size using a 1 psig pressure differential.
 - b. Two-Way Modulating: Size using 3 psig or equal to the load pressure drop, whichever is greater. Size for the design flow with the disc at 60-degree open position and the design velocity less than 12 FPS.
 - c. Effective Cv: for any valve smaller than line size, the pressure drop due to the reduction in pipe size shall be taken into effect.
- D. Pressure-Independent Hydronic Ball-Style Control Valves
 - 1. Manufacturers
 - a. Belimo (PIQCV up to 3/4"; ePIV for 1" and up)
 - 2. General
 - a. Valve shall meet all the requirements set forth in the Hydronic Ball-Style Control Valve section, in addition to the requirements below.
 - b. Operating Differential Pressure Range: 5 to 50 psid or better.

- c. The flow through the valve shall not vary more than +/- 5% due to system pressure fluctuations across the valve in the selected operating range. The control valves shall accurately control the flow from 0 to 100% full rated flow.
- 3. Construction
 - a. Mechanical pressure regulation style PIC valves shall have factory installed pressure/temperature test ports (Pete's Plugs) across the pressure regulator at the factory.
 - b. Pressure independent control valves 1" NPT or larger may use ultrasonic flow measurement. The ultrasonic flow meter will meet the specifications herein.
- 4. Flow Characteristics: see Hydronic Ball-Style Control Valves.
- 5. Sizing
 - a. Valve shall be sized at line size for the GPM specified of MEP Equipment.
 - b. Provide minimum and maximum full-open pressure drop of valves.

PART 3 - EXECUTION

3.1. GENERAL INSTALLATION

- A. Install aspirating guards on wall-mounted devices in the following locations:
 - 1. Building entrances.
 - 2. Public areas.
 - 3. Where indicated on construction documents.
- B. Exposed wire nuts, including in plenum, will not be acceptable. All connections will be made inside a rated enclosure.
- C. Install labels and nameplates to identify control components according 15190.
- D. Install hydronic instrument wells, valves, and other accessories according to Division 15.
- E. Install refrigerant instrument wells, valves, and other accessories according to Division 15.
- F. Smoke detectors, high and low limit thermostats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.
- G. Coordinate fire alarm relay connections to the fire alarm system with the fire alarm installer.
- H. Where sensors have a display, mount such that display can be read from ground.
- I. Install sensors in visible and accessible areas. Do not hide sensors on top of ductwork or insulate over sensors.
- J. For sensors on rigid insulation for duct or piping, install sensor prior to insulation. Sensors installed after insulation will be required to cut and seal insulation around sensor.
- K. Sensors requiring an external power source shall use DC power from switching DC power supply. Do not use alternating current for sensors unless specifically required by the manufacturer. Do not use on-board DC power for sensors unless specifically required by the manufacturer.

3.2. TEMPERATURE/HUMIDITY/WALL MODULE AND ROOM SENSORS INSTALLATION

- A. Verify location of thermostats, humidistats, and other exposed control sensors with Contract Documents and room details before installation. Install devices 48 inches above the floor per ADA requirements. The location(s) to be selected by Owner. No sensor shall be mounted until the Owner and/or Owner Representatives give specific location instructions. Do not

install sensor(s) on the inside of exterior building walls (including column fur outs) unless explicitly approved by Owner.

- B. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.
- C. Install outdoor air temperature and humidity sensors on north-facing wall at designated location. If sensor cannot be placed on north wall, submit RFI for approved location and provide with PVC sun shield and windscreen.
- D. Single-point temperature sensors may be used in ducts where there is no air stratification possibilities. Sensor shall be mounted sufficiently downstream to allow for sufficient mixing, five to ten duct diameters at a minimum.
- E. Install mixing plenum sensors in a serpentine manner horizontally (not vertically) across duct. Support each bend with a capillary clip.
- F. Thermowells to be installed in piping. Contractor to "stub-up" any thermowell which is too long to install directly into piping. Install heat-conducting fluid in thermowell prior to installing sensor.
- G. Install heat-conducting fluid where strap-on temperature sensors contact piping. Sand and clean piping prior to installation. Insulate around sensor.
- H. Install cooler/freezer sensors in rubber clamp to isolate sensor from surrounding metal. Run conduit inside cooler/freezer for sensor away from door and storage racks. After sensor has been checked out, seal all penetrations with low expansion insulating foam. Coordinate installation with cooler/freezer vendor.
- I. Install humidity sensor in areas where relative humidity will not rise above 90% RH. If area will have high humidity consistently, relocate to different area and use dewpoint/psychrometric calculations to calculate relative humidity of the area required.
- J. Wall Modules
 - 1. Limit setpoint adjustment to ± 3 deg F unless otherwise specified on the Drawings.

3.3. PRESSURE SENSOR INSTALLATION

- A. Supply (Positive) Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube/probe. Make pressure tap connections according to manufacturer's recommendations.
- B. Return (Negative) Duct Static Pressure. Pipe low-pressure tap to duct using a pitot tube/probe. Make pressure tap connections according to manufacturer's recommendations.
- C. Room Pressure: Pipe appropriate pressure sensor port (positive space: high pressure, negative space: low pressure) to room. Pipe opposite pressure point to reference outside of room. Connect to stainless steel mesh snubber mounted to white 2 in by 4 in plate at locations on drawings.
- D. Building Static Pressure. Pipe pressure sensor's low-pressure port to the static pressure port located on the outside of the building through outside air reference kit. Mount kit per manufacturer's instructions. Pipe high-pressure port to stainless steel mesh snubber mounted to white 2 in by 4 in plate at locations on drawings.
- E. Pressure transducers, except those controlling VAV boxes, shall be located in Control Panels, not on MEP Equipment or on ducts. Mount transducers in a vibration-free location accessible for service without use of ladders or special equipment.
- F. Do not install tees for TAB purposes in air pressure tubing. Remove tees where found.
- G. Install differential pressure sensor valve manifold at eye level. Provide hard copper tubing from water mains to valve manifold; soft copper not allowed. Provide isolation valves in tubing prior to valve manifold.

3.4. CURRENT SWITCHES/TRANSDUCER INSTALLATION

- A. Wire may be “wrapped” around CS/CT to obtain better status indication.
- B. CS/CTs requiring commissioning/startup will be done per manufacturer installation instructions.

3.5. AIR FLOW MEASUREMENT STATIONS (AFMS) INSTALLATION

- A. Install AFMS in locations indicated and required to perform the Sequences of Operation. Install AFMS in accordance with the manufacturer’s recommendations.
- B. Do not install AFMS sensors and probes until all sanding and grinding activities are complete to protect them from accumulating dust and debris.
- C. Prior to ordering, measure actual duct size as installed in field and provide to vendor.
- D. Mount transmitter at eye level. Measure distance from probe to transmitter and order wire whip of sufficient length to reach. Install probe wire whip in conduit of sufficient size for connector to pass through.

3.6. THERMOSTATS

- A. Install Freezestat/Low-Limit Duct Thermostat (LTD) in ducts and plenums in a serpentine manner horizontally (not vertically) across duct. Support each bend with a capillary clip. Provide rows at 12 inch spacing; the element covers a maximum of 6 inches above and below sensing element. At the bottom of the duct or plenum, the row with the tail end of the sensing element shall be a maximum of 6 inches from the bottom.

3.7. WATER FLOW AND BTU METER INSTALLATION

- A. Install water flow meters in locations indicated to perform the Sequences of Operation. Install water flow meter in accordance with the manufacturer’s recommendations.
- B. Do not install AFMS sensors and probes until all sanding and grinding activities are complete to protect them from accumulating dust and debris.
- C. Prior to ordering, measure actual pipe size and verify furnished material as installed in field and provide to vendor.
- D. Mount transmitter at eye level. Measure distance from probe to transmitter and order wire whip of sufficient length to reach. Install probe wire whip in conduit of sufficient size for connector to pass through.
- E. Provide installation kit (i.e., threadolet, nipple/standoff, pipe tee, isolation valve, etc) to Mechanical Contractor for installation. Kit will be specific to the application. Installation accessories which are not provided by the vendor will not be acceptable.

3.8. RELAYS

- A. Nipple-mount relays will be mounted at a location where pilot light is visible from floor.

3.9. VALVES, DAMPERS, AND ELECTRONIC ACTUATORS INSTALLATION

- A. Wire parallel actuators according to manufacturer's recommendations.
- B. Dampers and Damper Actuators
 - 1. Install automatic dampers according to Division 15.
 - 2. Mount actuators directly on damper shaft or jackshaft unless shown as a linkage installation.
 - 3. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately the 5° open position, manually close the damper, and then tighten linkage.
 - 4. Provide necessary mounting hardware and linkages for actuator installation.

5. Install damper motors on outside of duct in climate controlled areas, including mechanical rooms. Provide sufficient standoff/offset of damper actuator from ductwork to allow for insulation behind actuator.
 6. Where clearance cannot be maintained, locations exposed to outdoor temperatures, or actuator is inside ductwork, provide 12 inch by 12 inch access door per specifications for any actuator inside of ductwork.
- C. Control Valves and Valve Actuators
1. Provide sufficient standoff/offset of valve actuator from piping to allow for insulation of valve.
 2. PIC Valves
 - a. Where not provided from the factory, install pressure/temperature test ports (Pete's Plugs) for testing of pressure differential across the PIC valve.
 - b. For PIC valves with electronic flow metering, coordinate with mechanical contractor to ensure 5 pipe diameters of straight pipe entering valve.
 3. Steam Valves
 - a. Mount actuators at a minimum 30 degree angle compared to vertical. Do not mount actuator directly above steam valve or piping.

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART I: GENERAL

Control system contractor shall be responsible for selection of the proper control valves including line size, pressure rating, flow-coefficient, shutoff rating and allowable leakage factor. Valves will be turned over to the Division 15 Contractor for installation.

Modulating water valves shall be sized for nominal 5 psi pressure drop and close off. All 2-way valves shall have contoured or characterized throttling plugs with linear (for steam applications) or equal percentage characteristics.

The controls contractor shall calculate the required Cv for each valve. Valve Cv shall be within 100 percent to 125 percent of the Cv calculated.

Fan coil valves and AHU central station actuators shall operate from either a 0-10Vdc or a 4-20ma signal.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Belimo
2. Delta
3. Approved equal

2.2 CONTROL VALVES

- A. Valves 1/2 inch through 2 inches shall be ball valve type assemblies industrial quality with bronze bodies and NPT screw type and shall be rated for 600 psig (40 bar) working pressure - or two-way and 400 psig (27 bar) for three-way. The operating fluid temperature range shall be 20' F to 2500 F (-70C to 1200C).
- B. The actuator and its mounting plate shall be capable of being repositioned on the square mounting bracket in 90 degree increments parallel or perpendicular to the pipe. Non-metallic thermal isolation standoffs shall separate mounting plate from actuator with high temperature materials rated for continual use at greater than the application temperature. Valve assemblies without thermal isolation as described above are not acceptable.
- C. The mounting bracket shall be of rigid structural metal incorporating a shaft of stainless steel positioned parallel and perpendicular to the packing and stem to prevent lateral or rotational forces from affecting the stem and its packing. The mounting bracket shall be positioned so as to allow the insulation of the valve body and bracket to allow removal of the actuator without disturbing the insulation. Valves shall have either ISO-5211 style mounting pads or machined mounting surfaces. The shaft shall be supported by an upper bearing.
- D. All control ball valves shall be furnished with a 316 stainless steel ball & stem and carbon and graphite reinforced Teflon O seats and seals.
- E. Ball valves for low pressure steam applications shall have 316 stainless steel ball, stem, and drive shaft and rated at a maximum of 600 psi working pressure. Valves shall be installed in the piping at 45 degree angle from vertical. Valve and actuator mounting bracket shall be fully insulated.
- F. The valves shall have a blow out proof stem design.

- G. Each valve shall be functionally tested by the valve manufacturer.
- H. Flow type for modulation shall have equal percentage and linear flow characteristics for two-way and three-way valves, respectively.
- I. Two-way stem packing shall consist of stacked "V" ring and spring (live) loaded packing requiring no maintenance. Three-way stem packing shall consist of EPDM O-ring requiring no maintenance and no adjustment to meet complete operating life. Valves requiring packing adjustment throughout the life of the valve are unacceptable.
- J. Valves 3 inches and larger shall be butterfly valves.
- K. Butterfly valves shall be threaded lug type suitable for dead-end service and for modulation to the fully-closed position, with carbon-steel bodies and noncorrosive discs, stainless steel shafts supported by bearings, have flanged-end connections, and EPDM seats suitable for temperatures from minus 20 degrees to plus 250 degrees F. All valves shall have a manual means of operation independent of the actuator. Provide valve manufacturer's insulation casing.
- L. Manufacturer shall provide a two year "no hassle" unconditional warranty from date of installation.

2.3 CONTROL VALVE ACTUATORS

- A. The actuator manufacturer shall have ISO 9001 quality certification.
- B. Actuators shall be Underwriters Laboratories Listed under Standard 873 and Canadian Standards Association Class 4813 02. Actuators shall have European Community (CE) certification.
- C. Actuators used near outdoor air streams shall have NEMA type 2 (IP54) housings for water and moisture resistance.
- D. Actuators shall be mounted on the valve by the manufacturer.
- E. Actuators shall be applied according to the manufacturer's specifications.
- F. Actuators shall be fully modulating or 2-position (with fail-safe mechanical spring return) as indicated on drawings.
- G. The valve actuator shall be capable of providing the minimum torque required for proper valve close-off for the required application.
- H. Each actuator shall have current limiting circuitry or microprocessor overload protection incorporated in its design to prevent damage to the actuator. End of travel switches are not acceptable.
- I. Actuators shall have mechanical spring return for fail safe mode where specified. Battery backup units or storage capacitor type units contained within the individual actuators are not acceptable.
- J. Powering shall be 24VAC, 24VDC, 120VAC, or 230VAC. Feedback signal shall be available to provide a DDC input signal or to drive a second slave or tandem actuator. The actuator shall have the capability of adding auxiliary switches or feedback potentiometer if required.
- K. A release button and optional handle on the actuator shall be provided to allow for manual override on non-spring return assemblies.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install control valves in strict accordance with manufacturer's published instruction manual.
- B. Install control valves with necessary clearance around ball valve assembly.
- C. Install control valves to provide access for periodic maintenance, including removal.
- D. Insulate valve body, not actuator.
- E. Install control valves to prevent condensate forming on valve body to travel into actuator.
- F. Piping installation requirements are specified in other Division 15 Sections.
- G. Electrical power and control wiring and connections are specified in other Division 15 & 16 Sections

PART 4: COMMISSIONING

Schedule service of factory trained representative to inspect installation and provide instruction on maintenance to Owner.

PART V: WARRANTY

Manufacturer shall guarantee the system as installed to be free from manufacturing defects for a period of 2 years from startup not to exceed 30 months from shipping to job site under normal use.

END OF SECTION

GENERAL:

Electrical Contractor shall provide rough-in, junction box, or wiring trough as indicated. All external disconnect switches, motor starters, and any fuses required for equipment furnished under Division 15 shall be provided by the Mechanical contractor and shall be installed by the Electrical Contractor. Coordinate all equipment locations with all other contractors prior to installation of equipment. Consult all Contract drawings which may affect location of equipment or apparatus and make any minor adjustments as required. Electrical Contractor is responsible for all line side and load side wiring for all equipment requiring electrical power. Line side wiring is defined as the wiring from the distribution panel circuit to the point of disconnect (internal or external) for the equipment, whether provided by the contractor or factory installed by the equipment manufacturer. Load side wiring is defined as the wiring from the point of disconnect to all equipment requiring electrical power. All final electrical terminations to the piece of equipment shall be done by the Mechanical contractor.

All control switches for remote equipment shall be provided with on/off indicator lights at the switch.

Ensure that all rotating equipment has a power disconnect available within sight of the equipment, regardless of whether required by the NEC. Coordinate exact locations with Electrical Contractor prior to rough-ins.

The HVAC Contractor shall also provide all control wiring, conduit, equipment interlocks, low voltage device or motor power connections, and similar in accordance with this section or Division 16 of these specifications. Provide all necessary cabinets, panels, junction boxes, interconnecting signal cabling & associated hardware, transformers, relays, engineering support, etc. for a complete and operational system that executes the specified control sequence of operation.

MOTOR STARTERS, CONTROLLERS AND CONTACTORS:

Motor controllers and contactors shall be as indicated or specified and shall be furnished under each Section of this Division requiring such controllers unless otherwise indicated to be provided in a Motor Control Center under Division 16. Motor Starters, Controllers, and Contactors shall be furnished by the HVAC Contractor and installed by Electrical Contractor.

Motor controllers shall, unless otherwise specifically noted, be combination magnetic type, with thermal overload relays and heaters in each phase conductor, with operating coils for 120 volts as noted on the drawings or as required. Maximum trip rating of starters for hermetic motors shall be at least 105% of the nameplate full load current of the motor.

Starters shall be provided with build-in selector switches (H-O-A) or pushbutton stations where required. Combination starters shall be provided with sufficient auxiliary contacts or control relays for control sequence as specified, indicated or as required, and with sufficient auxiliary contacts on its circuit breaker or with control relays so that opening the circuit breaker ahead of the starter unit opens all hot control lines within the starters. All starters furnished under this Section shall be mounted in individual NEMA I enclosures, unless otherwise specified or indicated on drawings. Special requirements are specified in the separate Sections of this Division or indicated on the drawings.

Equipment shall be manufactured by Square D to match equipment furnished under Division 16

ROOM-INSTRUMENT MOUNTING:

Room instruments shall be mounted so that their switching devices are 54" maximum above the finished floor unless a clear space of 30" wide by 48" long for wheelchair access is not available, mount at 48" AFF to comply with the American Disability Act (ADA).

CONTROL WIRING:

Run control wiring in metallic raceway in masonry walls, boiler room and exposed conditions. All other signal cables shall be run on utility platform on wire management bridle hooks provided by this contract. Do not run inside raceway with power conductors. Use copper wire or control cable, #18 minimum (except that digital signaling can be NEC class 2). The contractor shall connect to junction box(s) or other termination points provided by the Electrical Contractor for control power. See Electrical Section of these specifications for materials and installation requirements. All wiring shall be color and number coded.

RELAYS:

Indexing relays shall be 24 VAC coils "relay in a box" with pilot light & off/on switch, IDEC or equal. All line side relay wiring shall be 12 AWG and in metallic raceway. Relays shall be installed in NEMA 1 enclosures.

CONTROL CABINETS:

Control cabinets shall be provided for mounting of control devices in utility platform and/or boiler room. Cabinet shall be UL listed lockable, code gauge gray painted steel, with knockouts, and hinged door. Enclosure shall be equal to Austin Co. CT series

Provide boiler room cabinet enclosure with swing-down table shelf for use with laptop computer.

CORRDINATION OF ELECTRICAL POWER REQUIREMENTS:

Mechanical contractor shall coordinate voltage and amperage requirements for all HVAC equipment with the Electrical Contractor prior to ordering equipment submittals. Make adjustments to equipment voltage or phase requirements as necessary to match electrical power being provided. Make engineer/architect aware of any conflicts or issues.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

ADJUSTMENT AND TRIAL RUNS:

Upon completion of all work, the Contractor shall operate the plant in the presence of the engineer for the purpose of demonstrating quiet and satisfactory operation, the proper setting of controls, safety and relief valves, and cleanliness of system. Heating and cooling shall be tested separately during periods approaching the design conditions and shall fully demonstrate fulfillment of capacity requirements. Test procedures shall be in accordance with applicable portions of ASME, ASHRAE and other generally recognized test codes as far as field conditions will permit.

AIR BALANCING & TESTING:

Air Balancing and System Testing includes (1) balancing air distribution, (2) adjustment of total system to provide design quantities, (3) electrical measurement, (4) verification of performance of all equipment and controls, and (5) sound and vibration measurement. Contractor shall provide all required instrumentation and equipment required to obtain proper measurements. Contractor shall perform final test and balance of selected areas in presence of Engineer. The following procedure is adapted from the 1995 ASHRAE Applications Handbook, Ch. 34: Testing, Adjusting and Balancing, and Associated Air Balance Council:

- (1) All supply and return air-duct dampers are set at full open position. All diffuser and side-wall grilles are set at full open position. Outside-air damper is set at minimum position. All Controls are checked and set for full cooling cycle. Branch liner splitter dampers are set to open position. All extractors and distribution grids are set in wide-open positions.
- (2) Drill all probe holes for static-pressure readings, pitot tube traverse readings, and temperature readings. Check motor electric current supply and rated running amperage of fan motors. Check fan and motor speeds. Check available adjustment tolerance.
- (3) Make first complete air-distribution run throughout entire system, recording first-run statistics. Using pitot tube traverse in all main ducts, branch ducts, and supply and return, proportion all air in required amounts to the various main-duct runs and branch runs. Make second complete air-distribution run throughout entire system for check on proper proportion of air.
- (4) Using pitot tube traverse, set all main-line dampers to deliver proper amount of cfm to all areas. Using pitot tube traverse, set all branch-line dampers to deliver proper amount of cfm to diffusers amount of cfm to diffusers and side-wall supply grilles in each zone. Read cfm at each outlet and adjust to meet requirements. Test and record all items as listed on attached form.

Final air balancing form (3 copies) submitted to Engineer shall be on attached form adapted from the Associated Air Balance Council (AABC) and the National Environmental Balancing Bureau (NEBB).

HYDRONIC BALANCING & TESTING:

Hydronic Balancing and System Testing includes (1) bleeding air at all system high points, (2) adjustment of total system to provide design flows, (3) pressure drop measurements & head loss calculations, (4) verification of performance of all pumps, automatic control valves and system controls, and (5) sound and vibration reduction. Contractor shall provide all required instrumentation and equipment required to obtain proper measurements. Contractor shall perform final test and balance of selected equipment in presence of Engineer. The following procedure is adapted from 1995 ASHRAE Applications Handbook, Ch. 34: Testing, Adjusting and Balancing, and the Bell & Gossett Engineering Design Manual:

- (1) Perform air test & balance as specified above.
- (2) Flush & clean system as specified Section 15745. Remove & clean all strainers. Verify correct pump rotation. Pumps shall operate air-free without cavitation. Set automatic fill valves to required pressure.
- (3) Check expansion tanks to verify if system is not water-logged or air-locked. Check all manual air-vents installed at all system high points - bleed all air out of system completely.
- (4) Set all valves at full open position. Close coil bypass valves. Set temperature controls for full flow through all coils.
- (5) Verify correct operation of all automatic control valves. Set operating temperature of chillers to design leaving water temperature.
- (6) Take differential pressure measurements across all pumps & coils. Take power measurements of pump motors in watts (power factor calculated). Use pump manufacturer's published pump curves to determine flow rate.

END OF SECTION

AIR BALANCE REPORT

Project: _____
Contractor: _____
Date: _____
Air Balanced by: _____
Instrument Mfr #: _____
Date Calibrated: _____

System No. _____
CFM: _____
S.P.: _____
Fan RPM: _____
Motor Voltage: _____
Motor Amperage: _____

Location	No.	Model/Size	Effective	Design Values		Field Test		Final Test		% DEV.
			Area	FPM	CFM	FPM	CFM	FPM	CFM	
	1									
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
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PROCEDURE/NOTES:

- (1) Review Specification Section 15980 prior to air test & balance.
- (2) Ensure fan is providing specified air volume within 5%.
- (3) Set all dampers to full open position prior to first field test.
- (4) Identify air distribution device nos. on HVAC as-built drawing.
- (5) Adjust dampers accordingly and recheck entire system as required.
- (6) Acceptable % deviation is +/-10%.

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

EVALUATION:

Upon completion of all work, the Contractor shall operate the plant in the presence of the engineer for the purpose of demonstrating quiet and satisfactory operation, the proper setting of controls, safety and relief valves, and cleanliness of system. Heating and cooling shall be tested separately during periods approaching the design conditions and shall fully demonstrate fulfillment of capacity requirements. Weather-dependent test procedures that cannot be performed by simulation shall be performed in the appropriate climatic season. When simulation is used, the Contractor shall verify the actual results in the appropriate season.

The Contractor shall make the observations, adjustments, calibrations, measurements, and tests of the control systems, tune the controllers, set the timeclock schedule, and make any necessary control-system corrections to ensure that the systems function as described in the sequence of operation. The Contractor shall permanently record, on system equipment schedule, the final setting of controller proportional, integral and derivative constant settings, setpoint, manual reset setting, maximum and minimum controller output, and ratio and bias settings, in units and terminology specific to the controller.

Test procedures shall be in accordance with applicable portions of ASME, ASHRAE, NEBB and other generally recognized test codes as far as field conditions will permit.

CLEANING:

All surfaces on metal, pipe, insulation covered surfaces, and other equipment furnished and installed under this section of the specifications shall be thoroughly cleaned of grease, scale, dirt, and other foreign materials. Prior to final inspection, all equipment having factory finishes shall be thoroughly cleaned inside and outside. All damaged surfaces shall be replaced or refinished by Contractor, with paint same as original manufacturer. Engineer shall determine whether the damaged surface is to be replaced or painted.

EQUIPMENT IDENTIFICATION:

Provide black-on-white laminated plastic name plates for each AHU & FC equipment unless indicated otherwise on the drawings. The name plate shall be engraved to indicate the equipment controlled or identified. Name plates shall be securely fastened to equipment using two screws.

MAINTENANCE AND OPERATING MANUALS:

Upon completion, the MC shall turn over to the Architect three (3) sets of complete Operation and Maintenance Manual and parts list for all mechanical equipment used on the job. Manuals shall include submittal data, manufacturer's recommended maintenance, warranties, and name, address, and phone numbers, both Contractor and of suppliers of equipment.

The Operation and Maintenance Manual shall include in addition to manufacturer's operation and maintenance guides and parts list, a maintenance schedule indicating recommended frequency of service, a blank service repair log for recording date, description of maintenance, and parts purchased, and an air filter replacement schedule indicating size and quantity for each HVAC unit.

INSTRUCTION & TRAINING:

Upon completion of the work, and at a time designated by the Architect, with no less than 10 days prior notice, a competent employee of the Contractor shall be provided for a period of not less than one (1) day

to instruct a representative of the Owner in the operation and maintenance of the equipment. Systems requiring manufacturer's representative as specified elsewhere shall be scheduled in same manner. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

SCOPE OF WORK:

The scope of work consists of the furnishing and installing of complete electrical systems including miscellaneous systems. The Electrical Contractor (hereafter referred to as "the Contractor", or Electrical Contractor) shall provide all supervision, labor, materials, equipment, machinery, and any and all other items necessary to complete the systems. The Contractor shall note that all items of equipment are specified in the singular; however, the Contractor shall provide and install the number of items of equipment as indicated on the drawings and as required for complete systems.

It is the intention of the Specifications and Drawings to call for finished work, tested and ready for operation.

Any apparatus, appliance, material, or work not shown on the drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered, and installed by the Contractor without additional expenses to the Owner.

Minor details not usually shown or specified, but necessary for proper installation and operation, shall be included in the Contractor's estimate, the same as if herein specified or shown.

With submission of bid, the Contractor shall give written notice to the Architect of any materials or apparatus believed inadequate or unsuitable, in violation of laws, ordinances, rules, and any necessary items or work omitted. In the absence of such written notice, it is mutually agreed that the Contractor has included the cost of all required items in his proposal, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensation.

NOTICE TO BIDDERS, INSTRUCTIONS TO BIDDERS, SUPPLEMENTARY INSTRUCTIONS, GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, SPECIAL CONDITIONS, GENERAL REQUIREMENTS bound in the front of this document are included as a part of the specifications for this work.

ELECTRICAL DRAWINGS AND SPECIFICATIONS:

The electrical drawings are diagrammatic and indicate the general arrangement of fixtures, equipment, and work included in the contract. Consult the architectural, structural, plumbing, fire alarm, integrated communications, and mechanical drawings and details for exact locations and dimensions of fixtures and equipment; where same are not definitely located, obtain this information from the Architect.

The Contractor shall follow drawings in laying out work and check drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, the Architect shall be notified before proceeding with installation. If directed by the Architect, the Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

The plans and these specifications are intended to describe, imply and convey the materials and equipment as well as necessary labor, required for the installation as outlined in the paragraph entitled "Scope of Work". Any omissions from either the drawings or these specifications are unintentional, and it shall be the responsibility of this Contractor to call to the attention of the Architect or Engineer any pertinent omissions before submission of a bid. The drawings which accompany these specifications are not intended to show in complete detail every fitting which may be required; however wherever reasonable implied by the nature

of the work, any such material or equipment shall be installed by this Contractor as a part of his contract price. In no case will any extra charge be allowed unless authorized in writing by the Architect or Engineer.

The Contractor shall arrange with the General Contractor for required concrete and masonry chases, openings, and sub-bases so as not to delay progress of work. Work shall be installed sufficiently in advance of other construction to conceal piping and to permit work to be built in where required.

It shall be understood and agreed by all parties that where the words "Furnish", "Install", and / or "Provide" appear, the following definitions apply:

Furnish - to supply or give.

Install - to place, establish or fix in position.

Provide - to furnish and install as defined above.

CODES, PERMITS, AND FEES:

The Contractor shall give all necessary notices, including electric and telephone utilities, obtain all permits, and pay all government taxes, fees, and other costs, including utility connections or extensions in connection with his work file all necessary plans, prepare all documents, and obtain all necessary approvals of all governmental departments having jurisdiction at each phase of construction as required; obtain all required certificates of inspection for his work and deliver same to the Architect before request for acceptance and final payment for the work.

The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings (in addition to contract drawing and documents) in order to comply with all applicable laws, ordinances, rules, and regulations, whether or not shown on drawings and / or specified.

All work and materials under this section shall be in strict compliance with more stringent requirements of the North Carolina State Building Code, including the National Electrical Code, NFPA 101-Life Safety Code, Regulations of the State Fire Marshall, UL Directory of Electrical Construction Materials, and requirements of the local utility company.

VERIFICATION OF DIMENSIONS, DETAILS, EXISTING FIELD CONDITIONS:

The Contractor shall visit the premises prior to bidding, and thoroughly familiarize himself with all details of the work, working conditions, verify dimensions in the field, provide advice of any discrepancy, and submit shop drawings of any changes he proposes to make in quadruplicate for approval before starting any work. The Contractor shall install all equipment in a manner to avoid building interference.

COORDINATION WITH EQUIPMENT PROVIDED BY OTHERS:

Electrical contractor shall coordinate voltage, phase and amperage requirements for all Plumbing, HVAC, and Kitchen equipment with the sub-contractor providing the equipment prior to ordering electrical gear submittals. Make adjustments to panels, feeders, and breakers as necessary to feed actual equipment being provided. Make engineer/architect aware of any conflicts or issues.

ACCEPTABLE MANUFACTURERS:

Acceptable manufacturers, as specified in the Contract Documents, implies that the specified manufacturer may produce acceptable products equal in quality of materials and performance to such item specified. The Contractor will be required to provide products meeting or exceeding the "Standard of Quality and Performance" as dictated by the product selection noted. However, any changes which result (from substitution of other manufacturers) in the electrical work or work of other Contractors, shall be paid for by the Contractor.

SHOP DRAWINGS:

The Contractor shall submit five (5) copies of the shop drawings to the Architect for approval within thirty (30) days after the award of the general contract. If such a schedule cannot be met, the Contractor may request in writing for an extension of time to the Architect. If the Contractor does not submit shop drawings in the prescribed time, the Architect has the right to select the equipment.

Provide manufacturer's cuts of items to be provided under this Contract. Included, but not limited to these items, are any of the following which may be required in this Contract: Fixtures, switches, outlet boxes, device plates, panelboards, transformers, conductors, pull boxes, wiring troughs, circuit breakers, disconnect switches, emergency fixtures, receptacles, etc.

The shop drawings shall be neatly bound in five (5) sets and submitted to the Architect with a letter of transmittal. The letter of transmittal shall list each item submitted along with the manufacturer's name.

Approval rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are approved, said approval does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawings and specifications.

COORDINATION WITH OTHER TRADES:

Coordinate all work required under this section with work of other sections of the specifications to avoid interference. Bidders are cautioned to check their equipment against space available as indicated on drawings and shall make sure that proposed equipment can be accommodated. If interferences occur, Contractor shall bring them to attention in writing, prior to signing of contract; or, Contractor shall at his own expense provide proper materials, equipment, and labor to correct any damage due to defects in his work caused by such interference.

INSPECTION AND CERTIFICATES:

On the completion of the entire installation, the approval of the Architect and Owner shall be secured, covering the installation throughout. The Contractor shall obtain and pay for Certificate of Approval from the public authorities having jurisdiction. A final inspection certificate shall be submitted to the Architect prior to final payment. Any and all costs incurred for fees shall be paid by the Contractor.

EQUIVALENTS:

When material or equipment is mentioned by name, it shall form the basis of the Contract. When approved by the Architect in writing, other material and equipment may be used in place of those specified, but written application for such substitutions shall be made to the Architect as described in the Bidding Documents. The difference in cost of substitute material or equipment shall be given when making such request. Approval of substitute is, of course, contingent on same meeting specified requirements and being of such design and dimensions as to comply with space requirements.

EXCAVATING AND BACKFILLING FOR ELECTRICAL WORK: Refer to Sections 02202 & 02220.

CUTTING AND PATCHING:

On new work, the Electrical Contractor shall furnish sketches to the General Contractor showing the locations and sizes of all openings and chases, and furnish and locate all sleeves and inserts required for the installation of the electrical work before the walls, floors, and roof are built. The Electrical Contractor shall be responsible for the cost of cutting and patching where any electrical items were not installed or where incorrectly sized or located. The Contractor shall do all drilling required for the installation of his hangers. See also Section 01050.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

CONDUIT SYSTEM:

Furnish and install all conduits, or other raceways, fittings, boxes, and other component parts specified or required for completion and proper operation of the power distribution, fire alarm, data, security and other low voltage systems shown on the drawings. See also Fire Alarm, IC and Security drawings and coordinate closely with all of the Low Voltage System Sub-Contractors for their requirements during construction. All Fire Alarm conduit with associated junction boxes and covers shall be red in color.

Other than as noted above, conduit shall be sized in accordance with the current NEC. All conduit shall be neatly installed parallel to, or at right angles to beams, walls and floors of the building in a neat and workmanlike manner. All bends shall be made with standard conduit elbows or conduit bent to not less than the same radius as that of a standard conduit elbow. Conduits shall be supported at intervals not greater than 8' and within 3' of any bend, cabinet, outlet or junction box. Conduits shall be supported by approved pipe straps or clamps, secured by means of toggle bolts on hollow masonry, expansion shields and machine screws or standard pre-set inserts on concrete or solid masonry, machine screws or bolts on metal surfaces, and wood screws on wood construction.

Conduit 3/4" (minimum) and larger shall be electrical metallic tubing (EMT). EMT shall be cold-rolled steel tubing with a coating on the outside and protected on the inside by a zinc, enamel, or equivalent corrosion-resistant coating and conforming to the requirements of ANSI C 80.3-1966 or later edition. EMT may be installed in dry construction in furred spaces, in partitions other than concrete and solid plaster, or for exposed work except on mechanical structures or supports, or in refrigerated areas. EMT shall not be installed where: it will be subject to physical damage; where it will be installed nearer than 4' from finished floor in exposed areas; where it will be subject to severe corrosive influence; where the trade size is larger than 2"; where it will be installed in masonry walls; or where tubing, elbows, couplings, and fittings would be in concrete or in direct contact with the earth. Electric metallic tubing fittings shall be all plated steel hexagonal threaded compression type, with insulated throats. No pot metal, set screw, or indenter fittings shall be used. PVC conduit shall be used in masonry wall construction. Contractor shall transition to EMT or rigid conduit at the top of masonry walls. PVC conduit shall not be used in stud walls.

Connections to lighting fixtures will be permitted with flexible steel conduit strapped every 6'-0", with UL listed AC type cables, used in strict accordance with current NEC Article 333. Armored Cable assembly shall encase conductors in a continuous length of galvanized cold rolled steel strip, spirally wound with adjacent strips locked to turn all edges inward. The ends shall be terminated with fiber bushings to protect conductors from sharp edges. Fittings shall be the insulated throat type, T & B 3100 series or equivalent.

All underground conduit shall be UL Listed Schedule 40 PVC conforming to Article 347 of the current NEC, or rigid galvanized steel. At the Contractor's option, this installation may consist of rigid steel conduit with PVC coating, minimum of 15 mils of PVC. Where schedule 40 PVC is installed under floor slabs, the elbows required to turn the raceway up into cabinets, equipment, etc., shall be of rigid steel. A copper ground wire shall be installed in all PVC conduits. PVC conduit shall not be used above the floor slab, unless roughed-in masonry.

All exposed conduit to 5'- 0" above finish floor shall be rigid galvanized steel or IMC conduit. Liquid-tight flexible steel conduit with an extruded PVC jacket shall be used for connections to exterior motors and compressors. Liquid-tight flexible conduit fittings shall be insulated throat type, Appleton STB type or equal.

All permanent conduit stub-outs shall be sealed with galvanized standard water pipe caps immediately after installation. All conduits crossing expansion joints shall have approved type expansion fittings as manufactured by Crouse Hinds, Killark or Appleton. Fittings shall be of type to ensure ground continuity. Provide a 240 lb. tensile strength poly pull-wire in all empty conduits.

SURFACE MOUNTED RACEWAY:

Two piece metal surface mounted raceway shall be used in all cases where it is not possible or desirable to run conduit concealed in the wall unless specifically noted otherwise on the plans. Provide Wiremold 3000 Series or equal. Provide large divided two channel raceway (4000 Series) in locations where power and low voltage wiring are to be routed in the same raceway.

CABLE TRAY:

Cable trays shall be aluminum ladder style trays suspended from structural elements above. Locate in the platforms, IDF, MDF and other areas as indicated on plans. Changes in direction shall be accomplished by utilizing standard radiused 90 degree and 45 degree fittings from the same manufacturer. Ladder tray system shall be 18" wide minimum. Provide B-line or equal by Monosystems or TRG.

OUTLETS AND PULL BOXES:

All boxes shall be UL labeled or listed by an approved agency. At each location where required, an outlet box of a type to suit the intended use shall be installed. Boxes shall be fastened to building structure in an approved manner. Flush outlet, junction and pull boxes shall be pressed galvanized or sheradized steel, either square or octagonal with knockouts on tops and sides, and fitted with plaster covers where necessary to set flush with the finished surface. For use in hollow-core masonry walls, switch boxes shall be of sufficient depth to permit conduit to rise in the core with minimum cutting of block. Provide plaster rings or box extensions for flush devices with finish surface. Boxes for unplastered masonry walls shall be masonry type with device mounting ears on the interior of the box.

Convenience outlet boxes shall be generally mounted approximately 18" above floor, 48" above floor in mechanical equipment rooms and shop type areas, and 4" above counter backsplash, unless otherwise noted. Convenience outlets for drinking fountains shall be installed behind fountain enclosure so as not to be visible; coordinate with Plumbing Contractor.

Lighting switch outlet boxes shall be 4' above floor, unless noted or required otherwise. Where switches occur in 4' high tile walls, they shall be lowered by 6 inches.

Pull boxes shall be used as required in long runs of conduit to facilitate pulling of wires. All interior pull boxes shall be constructed of code gauge galvanized sheet metal, and not less than the minimum size recommended by the NEC. Boxes shall be furnished with screw-fastened covers. When several feeders pass through a common pull box they shall be tagged to indicate clearly their electrical characteristics, circuit number, and panel designation. Wire markers shall be as manufactured by W. H. Brady Co., or equal. In no case shall a pull box be installed in an inaccessible location. Boxes shall be provided with fixed or removable steel barriers for each circuit where two or more feeders pass through the box. In case of banked conduit runs consisting of more than two horizontal rows of conduits, where barriers would be impracticable, the cables for each conduit shall be tied together with heavy waxed twine and wrapped with one wrap of heavy grade tape.

Where two or more outlets are to be installed in one location, they shall be installed in gang boxes suitable for the intended purpose.

Outlet boxes for outdoor use, and for exposed use where not covered by fixture canopies, shall be cast metal suitable for the intended purpose, having integral threaded hubs, and of the weatherproof type with gasket. Provide special outlet boxes where indicated.

All junction boxes shall be marked with panel and circuit number which it contains.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

CONDUCTORS FOR 600 VOLTS OR LESS:

All conductors shall be copper with a minimum conductivity of 98% and shall be delivered to the job site in their original packages, marked or tagged as follows : UL label , size, type, and insulation of the wire; name of manufacturer and trade name of the conductor: and date of manufacture. All conductors shall be insulated for 600 volts unless otherwise indicated. Furnish and install all conductors specified or required for completion and proper operation of the various systems shown on the drawings.

Conductors shall be 600 volt type THW or THWN. Branch circuit conductor shall not be smaller than No. 12 AWG, except where specifically noted otherwise. Home runs originating more than 80' at 120 volts from panel location shall be No. 10 AWG minimum size. Wires No. 10 AWG and smaller shall be solid; wires No. 8 AWG and larger shall be stranded. Where branch circuits are fed through fluorescent fixture channels, use code grade type THHN or XHHW. All MC cables where permitted shall include a separate copper ground conductor sized per phase conductors.

Provisions of Section 210-5, Color Code, NEC, shall be strictly complied with. Color coding shall include feeders and mains and be consistent throughout entire system. For 120/208 volt systems, use black, red, and blue for phases A, B, & C respectively. For 277/480 volt systems, use brown, orange, and yellow for phases A, B, & C respectively.

All conductors in vertical raceways shall be properly supported at intervals not greater than those specified in Section 300-19 of NEC.

All wire and cable except as specifically stated otherwise, shall be of one of the following makes: Anaconda Wire and Cable Co., General Cable Corp., General Electric Co., or Okonite Co.

LOW VOLTAGE DATA & TWISTED PAIR CABLES:

Data – See Division 17 Specifications for data cable requirements.

Twisted Pair (Shielded or Unshielded) – Conductors shall be insulated copper. Coordinate requirements for type, size and quantity of conductors in the shielded or unshielded cables with the equipment being served by the twisted cables (Fire Alarm Equipment/Devices, Intercom Devices, Speakers, Amps, phones, etc.).

Any low voltage cable that is not installed in a conduit or raceway shall be run concealed above ceilings or in the mechanical platforms. They must be properly supported with j-hooks or cable management devices that clip onto ACT support wires that are specifically designed for the purpose of supporting the cables. Zip ties are NOT acceptable as a method of securing/supporting cables. Zip ties may be used to bundle cables for easier management and neatness of installation.

JOINTS AND CONNECTIONS:

The Engineer reserves the right to inspect any and all joints made in wiring. If they are taped prior to being inspected, the tape shall be removed as ordered from any joint or joints for inspection. After inspection and correction of any fault found, the Contractor shall properly retape the joints.

Conductors shall be continuous without joints or splices in runs between outlet boxes. All splices shall be made at boxes only. Where stranded conductors are to be connected to any apparatus, bus work, switches or fuse blocks, they shall be connected by suitable mechanical solderless type lugs or spades. All lugs shall be

permanently bolted in such position as to give maximum contact surface available. Where multiple circuits are run from same switch or panel, individual lugs for each conductor shall be used. Feeder taps in junction boxes or panel gutter shall be made with insulated cover panel gutters. Feeder conductors shall not be spliced, feeder conductors shall be continuous for the length of run.

Solid conductors, namely those sized #10 and #12 AWG copper, shall be spliced by using Ideal "wire-nuts", 3M Co. "Scotchlok", or T & B "Piggy" connectors for branch circuit splices in junction boxes and light fixtures, except recessed fixtures as noted above. "Sta-Kon" or other other permanent type crimp connectors shall not be used.

Stranded conductors, namely #8 AWG copper and larger, shall be spliced by approved mechanical connectors plus gum tape, plus friction or plastic tape. Solderless mechanical connectors, for splices and taps, provided with UL approved insulating covers, may be used instead of mechanical connectors plus tape.

DEVICE PLATES:

A device plate shall be provided for each outlet to suit the device installed. All plates shall be no. 302 stainless steel construction. All plates shall be "jumbo" size.

Device plates shall be of the one piece type, of suitable shape for the devices to be covered. The use of sectional device plates will not be permitted. Plates having a .375" bushed hole in the center shall be installed on all wall mounted outlets for telephones.

Devices and/or plates installed prior to painting shall be properly taped and shall be cleaned after painting, if necessary. Blank plates shall be installed on all unused outlets.

Plates shall be manufactured by Pass & Seymour, Bryant, or Hubbell. Provide sample of plates to Architect for approval.

RECEPTACLES:

Duplex convenience outlets for general use shall be rated 20 amperes, 125 volts, duplex, for standard parallel blade three-wire grounded type caps, Hubbell No. 5362-I (ivory), Leviton, Pass & Seymour or Arrow-Hart or approved equal. Color to be selected by Architect. Where outlets are installed vertically, ground plug position shall be on top and on right side where outlets are installed horizontally.

SPECIAL USE RECEPTACLES:

Provide special receptacles including receptacles with ground fault circuit interrupter protection, where needed, as required by equipment. Provide MOV-based transient voltage surge suppression devices (SS), where shown on plan. Tamper-resistant receptacles (TP) shall prevent insertion of objects other than a properly rated 2 or 3 wire plug using "floating" shutters. Equal devices by Hubbell, Leviton, Pass & Seymour or Arrow-Hart are considered acceptable.

WALL SWITCHES:

Wall switches shall be installed as shown on the drawings and shall be connected to provide control of the outlets indicated. Switches shall be rated at 20 amperes for 120 volts or 277 volts lighting circuits. Hubbell No. 1221 (or 1221-1), for single pole; Hubbell Catalog No. 1223 (or 1223-1) for 3-way; Hubbell Catalog No. 1224 (or 1224-1) for 4-way. Weather-proof switches shall be Hubbell No. 1781 single pole or Hubbell No. 1783 3-way. Provide sample of switches to Engineer for approval. Color of switches to be selected by Architect.

Automatic light switches shall have passive infra-red occupancy switch with light sensor to prevent light from switching on when daylight is above pre-set level. Switch shall be UL listed, have adjustable time delay of 30

seconds to 30 minutes, auto/off control, and minimum coverage of 900 square feet, Automatic light switch shall be UNENCO model no. D-IS.

Provide special purpose switches where noted on the drawings, or elsewhere. Equal devices by Pass & Seymour or Arrow-Hart are considered acceptable.

For wall switches indicated as dimmers on LED lighting, coordinate the exact 0-10 volt dimmer that is compatible with LED driver at 277V for the specific fixtures provided. Install the correct size wall box to accommodate the specific dimmer to be installed.

END OF SECTION

SERVICE EQUIPMENT AND POWER DISTRIBUTION:

Furnish, install and completely connect the circuit breaker type service, panelboard and distribution equipment as indicated. All construction shall meet applicable standards of ANSI, IEEE, and NEMA, and all equipment shall bear UL label insofar as it is available. Equipment shall be Square D QED, I-Line or QMB; equipment manufactured by Cutler-Hammer (Eaton) , General Electric, or ITE Siemens will be considered equal.

Provide a copper bus interior with an insulated neutral in the Main Distribution Panel. This neutral bus shall be the source for all insulated neutral conductors of the system. Jumpers shall be installed to connect the insulated neutral bus to the uninsulated grounding bus. The uninsulated grounding bus shall be the source of grounds for all grounding and bonding (not neutrals) of equipment. Equipment UL listed for use as a Service Entrance shall have the Neutral and Ground bars bonded together per Current NEC requirements.

Electrical contractor is responsible for providing all transformer and equipment data to gear supplier as necessary for the supplier to evaluate and coordinate any circuit breaker settings to ensure that downstream breakers trip prior to any upstream breakers.

LIGHTING AND POWER PANELBOARDS:

Panelboards shall be of the thermal-magnetic circuit-breaker type and shall consist of an assembly of single, double, and triple-pole breakers. Each circuit-breaker shall be bolted-in, removable without disturbing the adjacent units and shall have trip ratings as indicated. All multipole breakers shall be common trip. Ground fault circuit breakers shall be used as indicated on the drawings.

Each panelboard shall be installed in an appropriate cabinet of sufficient size with top 6'- 0" above finish floor and shall conform to the requirements of UL standard for cabinets and boxes. Standard cabinets with surface or flush type trim and door shall be used, as required. Cabinets shall have a minimum width of 20" unless noted otherwise. A neutral bar shall be provided in each panel with a terminal for each breaker. Grounding lugs shall be provided.

Cabinet shall be made of spot welded galvanized sheet steel not less than N.E.C. gauge with hinged door and trim of the same material. When closed, the door shall fit accurately in the opening provided and present a flush finish with the trim. The door shall be equipped with a key operated lock. Furnish one key with each lock. All door locks shall be keyed alike. Knockouts in cabinets are not acceptable. Cabinets shall be finished with manufacturer's standard painted finish.

On the inside of each door, a typewritten directory identifying each circuit shall be mounted in a suitable protective enclosure. Panelboards shall have laminated plastic designations on inside corresponding to feeder and drawing identifications.

Panelboards shall be Square D I-Line or NQOD Series or equal by Cutler-Hammer, General Electric, or Siemens.

SHUNT TRIP PROTECTION:

All electrical equipment located under a kitchen hood with a fire suppression system shall be protected by a shunt trip device that is interlocked with the suppression system. Upon activation of the suppression system the shunt device shall trip and disconnect power for the equipment under the hood. This may be done via individual shunt trip breakers or a single main breaker that is shunted upon activation of the suppression system. If a main shunt breaker is utilized no circuits should be fed from the respective distribution panel other than the circuits for the equipment under the hood. Elevator feeder circuits shall also be protected by a shut trip device if the elevator shaft and/or the elevator equipment room are protected by a fire suppression system. Coordinate with the General Contractor for final plans from the Sprinkler Design-Build Contractor.

SURGE PROTECTION:

Furnish and install transient voltage surge suppressor (TVSS) units where indicated on the drawing risers as 'SP' to protect AC electrical circuits from the detrimental effects of lightning, utility switching transients, AC motor transients, and other internal generated transients. TVSS shall comply with UL 1449, have a Category C pulse life for all protection modes (L-N, L-G or L-L where applicable), shall operate bio-directionally, and shall have a maximum single pulse current capacity of 50 KA per mode in accordance with NEMA LS1-1992. Acceptable manufacturers include Leibert, Current Technology, LEA, and United Power. Provide complete shop drawing submittal including installation instructions, dimensional drawings, clamp voltage data, and 3rd party data confirming single pulse current capacity rating. Provide on-site manufacturer's testing and start-up.

SAFETY DISCONNECT SWITCHES:

Disconnect switches shall be horsepower rated, installed where indicated and / or required by the NEC. Switches, except where shown as beined by other sections shall be furnished under this Section. Switches shall be heavy duty, fused unless otherwise noted, sized as shown, quick-make, quick-break, NEMA type "ND" with NEMA 1 enclosure, type HD, Square D. Switches to be installed outdoors shall be NEMA type 3R, with raintight conduit hubs. All switches shall be capable of being locked in the "off" position. Fuses shall be one-time, non-renewable types, dual-element, time-delay, Bussman or equal as required for application.

MOTOR STARTERS:

Motor controllers shall, unless otherwise specifically noted, be combination magnetic type, with thermal overload relays and heaters in each phase conductor, with operating coils for 120 volts as noted on the drawings or as required. Maximum trip rating of starters for hermetic motors shall be at least 105% of the nameplate full load current of the motor.

Starters shall be provided with build-in selector switches (H-O-A) or pushbutton stations where required. Combination starters shall be provided with sufficient auxiliary contacts or control relays for control sequence as specified, indicated or as required, and with sufficient auxiliary contacts on its circuit breaker or with control relays so that opening the circuit breaker ahead of the starter unit opens all hot control lines within the starters. All starters furnished under this Section shall be mounted in individual NEMA 1 enclosures, unless otherwise specified or indicated on drawings. Special requirements are specified in the separate Sections of this Division or indicated on the drawings.

LIGHTING CONTACTORS:

Each lighting contactor shall have heavy-duty ballast load rated contacts. Each contactor shall have mechanically held contacts, and silver cadmium oxide double break contacts. Contacts shall be field convertible with normally open and normally closed indicators. Each contactor shall be UL listed and CSA certified. All new lighting contactors for each new building shall be housed in a properly sized NEMA-1 enclosure with fully hinged and lockable door.

FIRE ALARM & HVAC CONTROLS:

Electrical contractor is responsible for all conduit and wiring required to power any fire alarm control or booster panels, magnetic door holders, and the HVAC Building Automation Controls system cabinets. There shall be at least (2) Fire Alarm and (2) HVAC control system circuits per wing of the school. Coordinate exact location and quantity of cabinets with Fire Alarm and Mechanical's Controls Sub-Contractor. Termination to Fire Alarm and HVAC controllers and to HVAC equipment shall be by controls contractor. Electrician shall use 1P-20A circuits designated as Fire Alarm or HVAC Controls on panel schedules or the closest available spare 1P-20A (120V) breakers for powering the controls system. Notify Engineer if circuits were not indicated and update panel directories on Record Drawings.

ELECTRONIC DOOR ACCESS CONTROL HARDWARE:

Electrical contractor is responsible for all conduit and wiring required to power any and all electronic door access control hardware that is part of the Door Access Control system. Electrical contractor shall coordinate the exact quantities and locations of the Electronic Door Access Control equipment with the Door Hardware Schedules located in the Architectural Drawings and with the Door Access Control section of the Door Hardware specification. Electrical Contractor shall use 1P-20A circuits designated as Door Access Controls on electrical panel schedules or the closest available 1P-20A (120V) breakers for powering the Door Access Control equipment. Notify Engineer if circuits were not indicated and update panel directories on Record Drawings.

GROUNDING:

Provide a bare stranded continuous copper grounded conductor, size as indicated, from the service equipment grounding bus to the cold-water service main where it enters the building ahead of main valve on water pipe main. Also, provide a driven ground per NEC 250-81 (a). Provide all necessary grounding clamps and full-size jumpers around all valves, meters, and similar fittings between point of connection and street main. The main grounding conductor shall be connected to the neutral conductor at one location only, within and on the low voltage side of the main transformer and more specifically the equipment grounding bus associated with the main insulated neutral bus in the MDP. The insulated neutral bus must be insulated and serve to provide the neutral source for all the insulated neutral conductors of the system. Jumpers shall be installed to connect the insulated neutral bus to the uninsulated grounding bus and all grounding and bonding of equipment (not neutrals) shall be attached to the uninsulated grounding bus.

System and equipment grounds shall be checked for proper value of resistance using the Megger ground tester in accordance with the method prescribed by the manufacturer of the instruments. Resistance of ground shall not be in excess of 25 ohms, measured to include the grounding cable. The Contractor shall report the results of these tests to the Engineer in writing. If the resistance cannot be reduced to the value prescribed above, further instructions will be given the Contractor.

All equipment connected under this section shall be grounded and shall conform with the more stringent requirements of the NEC, National Electrical Safety Code, the N. C. State Building Code, or this specification.

Panels, junction boxes, safety switches, disconnect switches, contactors, starters, motors, dry transformers, bus duct and other equipment shall be bonded to the conduit system with a grounding conductor by means of grounding locknuts and bushings as required hereinafter, except where conduit terminates in threaded hub or fittings. All joints or terminations shall be made with standard tapered pipe threads drawn tight to preserve electrical continuity.

Provide grounding bushings and copper jumpers across all concentric or eccentric knockouts and on all conduits larger than 1". Elsewhere, double-lock-nuts with plastic or fiber bushings, or a single lock-nut and malleable bushing may be used. If Contractor selects to use a single locknut and malleable bushing, care shall be taken that the full number of threads project through to permit the bushing to pull tight against the ends of the conduit, after which the lock-nut shall be made up sufficiently tight to draw the bushing into firm electrical contact with the box.

Where flexible conduits are used, provide grounding conductor within flexible conduit to ensure continuity of ground. Minimum size of jumper around flex shall be No. 10.

EQUIPMENT IDENTIFICATION:

Provide black-on-white laminated plastic name plates for each switch or circuit breaker on service equipment, disconnect switches, terminal cabinets, panelboards and wiring troughs. The name plate shall be engraved to indicate the equipment controlled or identified. Name plates shall be securely fastened to equipment using two screws.

CONNECTIONS TO EQUIPMENT:

Electrical Contractor shall provide rough-in, junction box, or wiring trough as indicated. Electrical Contractor shall provide and install disconnect switches and motor starters for equipment provided under Division 16. All external disconnect switches, motor starters, and any fuses required for equipment furnished under Division 15 shall be provided by the Div 15 contractor and installed by the Electrical Contractor. Coordinate all equipment locations with all other contractors prior to installation of electrical equipment. Consult all Contract drawings which may affect location of equipment or apparatus furnished by others and make any minor adjustments as required. Electrical Contractor is responsible for all line side and load side wiring for all equipment requiring electrical power. Line side wiring is defined as the wiring from the distribution panel circuit to the point of disconnect (internal or external) for the equipment, whether provided by the contractor or factory installed by the equipment manufacturer. Load side wiring is defined as the wiring from the point of disconnect to all equipment requiring electrical power. All final electrical terminations to the piece of equipment shall be done by the contractor providing the equipment.

Electrical Contractor must closely coordinate with the equipment supplier regarding Voltage, H. P., F. L. A., outlet mounting heights, connection cord plug-receptacle electrode configurations and other special wiring requirements.

Electrical Contractor is responsible for coordinating quantity and location of all sprinkler system devices with sprinkler contractor.

Electrical Contractor shall review the Architectural, Civil, Plumbing, Mechanical, Fire Alarm and IC plans to provide branch circuits and final connections to powered equipment furnished by others for complete and operational equipment. This is a sample list and may not represent all connections required:

- 1) MDF & IDF equipment racks
- 2) Data Equipment Racks not in MDF or IDF rooms.
- 3) HVAC Controls Equipment
- 4) Heat trace for freeze protection (See Mechanical Plans)
- 5) Controlled Access electrified security doors (See Door Hardware Schedule)
- 6) Sprinkler controls/panels
- 7) Projectors and associated screens
- 8) Hand Dryers (See Architectural plans and elevations)
- 9) Electric Water Heaters & Associated Recirculation Pumps (Refer to Plumbing Plans)
- 10) Dishwashers (Kitchen and/or Science Prep)
- 11) Clothes Washers and Dryers
- 12) Art Room Kilns and associated fans
- 13) Fire Pumps (Main and Jockey)
- 14) Fire Alarm Control Panels and Booster Panels (See FA Contractor Shop Drawings)
- 15) Fire Shutters (See Architectural Plans & Specifications)
- 16) Overhead Doors
- 17) Motorized Basketball Goals and/or Gym Divider Curtains
- 18) Scoreboards and Shot Clocks
- 19) Motorized Bleachers
- 20) PA Systems and associated amplifiers (Gym, Café, Auditoriums and MP Rooms)
- 21) Powered Hotboxes (See Civil Site Plan for exact locations)

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

LIGHTING FIXTURES:

Furnish and install all lighting fixtures as indicated on the drawings. Fixtures shall be complete with lens or reflector, lamps, and wired ready for operation at the completion of installation. All fixtures shall have UL approval under their latest rulings indicating that fixture is approved for the intended usage. This Contractor shall provide proper fixture frames to suit type and dimensions of ceilings, confirming ceiling data with Plans, Architectural RCP, and General Contractor prior to ordering fixtures.

All fixtures shall be self-supporting, independent of the suspended ceiling. Fixtures shall be secured to the structure at a minimum of two points at opposing ends by wire equal to gauge of wire suspending the ceiling. Where fixture channels are joined to form a continuous length, provide one hanger at each end of the run and at each joint. Damaged fixtures shall be replaced at Contractor's expense. All fixtures shall be wired with a "Luminaire Cable" that contains the 0-10v dimming conductors.

ELECTRONIC DRIVERS/BALLASTS:

LED ballasts shall be high efficiency factor electronic ballasts where indicated on schedule, designed for rapid start operation for LED lamps. 70% LED lumen maintenance at 60,000 hours (L70/60,000). 0-10V dimming driver, dims to 10% and contains non-isolated dimming leads. Electronic ballast shall have a frequency of operation of 20 KHZ or greater and operate without visible flicker. Driver/Ballast shall be UL listed Class P, CSA certified, sound rated "A", withstand line transients as defined in ANSE/IEEE C62-41 Category A, and meet FCC requirements of Rules and Regulations, Part 18 for non-consumer equipment. Electronic ballast casing temperature shall not exceed a 25°C rise over 40°C ambient temperature or not exceed 85°C total. Electronic ballasts shall be by Advance Transformer Co., model Mark V or approved equal by Motorola or Magnetek.

LAMPS:

All lamps shall be as manufactured by Sylvania, Phillips, or General Electric Co.. Incandescent lamps shall be inside frosted 130V extended service unless otherwise noted. The Contractor shall be responsible for replacing all lamps which burn out during warranty period starting after Owner accepts project.

Unless indicated otherwise on drawings, LED and/or fluorescent lamps shall have energy saving drivers/ballasts, and a 4000 K color temperature with a color rendering index of 80 or better.

High pressure sodium lamps shall be GE "Lucalox" series or equal with median value of rated life no less than 24,000 hours.

EMERGENCY LIGHTING:

Furnish and install specified battery-powered emergency lighting units where indicated on the plans. Emergency lighting unit shall comply with the State of North Carolina Department of Insurance Document entitled "Requirements for Battery Powered Emergency Lighting Units" all subsequent addenda. Fixture shall have test light and switch accessible and visible from floor.

EXIT LIGHTING:

Furnish and install LED emergency exit sign with battery backup, brown-out protection, pilot light, test switch, and regulated power supply, where indicated on the plans unless specified otherwise. Exit signs shall comply

with the State of North Carolina Department of Insurance Document entitled "Requirements for Electrically Powered Exit Signs" dated 20 March 1995 and all subsequent addenda.

EXIT & EMERGENCY LIGHTING CONTROLS:

Contractor shall make provisions for Building Automation System (BAS) under Division 15 to exercise batteries on 21 to 28 day cycles. Coordinate with MC during rough-in as required with junction box for low voltage input to contactor.

LIGHTING CONTACTORS:

Each lighting contactor shall have heavy-duty ballast load rated contacts. Each contactor shall be normally closed contacts with mechanically held operators for open position, and silver cadmium oxide double break contacts. Contacts shall be field convertible with normally open and normally closed indicators. Each contactor shall be UL listed and CSA certified. All new lighting contactors for each new building shall be housed in a properly sized NEMA-1 enclosure with fully hinged and lockable door.

OUTDOOR LIGHTING CONTROLS:

For outdoor lighting applications, furnish and install contactors rated for load and photocells. Contractor shall make provisions for Building Automation System (BAS) or energy management control. Coordinate with MC during rough-in as required with junction box for low voltage input to contactor.

Photocells where indicated on drawing, shall be mounted in weather-proof enclosure under eastern facing eaves/overhangs with turn-on / off operations at 3-5 fc. Photocell shall be intermatic type K4221, for 120V and K4233 for 277V applications. Acceptable manufacturers are Tork, Intermatic, or Paragon. Photo cells shall not control luminaires directly all luminaires shall be controlled through a lighting contactor. Coordinate photocell specified with contactor coil rating.

END OF SECTION

FIRE ALARM SYSTEM EXPANSION

Furnish and install all labor, materials and programming to expand the existing fire alarm system to accommodate the new devices being added for the Renovation or Addition to have a complete and operational campus Fire Alarm system at project's end.

The Scope of Work shall include:

- a. Provide and install all notification and activation appliances as indicated on the plans, required by the local AHJ and as required by the North Carolina Building Codes. Education occupancies require voice notification devices.
- b. Provide a complete set of Shop drawings including wiring diagrams and battery calculations. Provide signal booster panels or battery booster panels as required for a fully functional system. Coordinate any 120V power requirements and locations with the electrical contractor.
- c. Fire alarm cabling shall match existing cabling for type and class. Cables shall be in conduit or shall be plenum rated. They shall be supported by a cable tray or j-hooks at a minimum of 6'-0" on center spacing to prevent droops and sags. FA cabling shall not be allowed to rest on ACT ceiling tiles, grid or lights.
- d. Provide and install magnetic door holders at main corridor connections to other buildings or wings and as indicated on plans. Install a ceiling mounted smoke detector on each side of each magnetically held door. If required, coordinate any 120V power requirements and locations with the electrical contractor.
- e. In educational facilities, manual stations shall be provided with surface mounted clear polycarbonate covers with an integral sounder base (95 dB minimum). Power for sounder base shall be hard wired from the fire alarm system, battery powered sounder bases shall not be acceptable. STI Stopper II model STI-1130-PULL shall be the basis of design. Approved equals by other manufacturers are acceptable.
- f. Notify engineer a minimum of 3 days prior to doing testing for the authority having jurisdiction.

Fire Alarm System components shall be installed by a factory-authorized service organization with minimum five years of successful public school installation experience and licensed in N.C.

Fire Alarm System equipment and devices shall be by Notifier to match the existing NFS2-640 system equipment.

END OF SECTION

**DIVISION 16
SECTION 16899**

**ELECTRICAL
FIRE ALARM SYSTEM INSPECTION AND TESTING FORM**

DATE: _____

TIME: _____

SERVICE ORGANIZATION

PROPERTY NAME (USER)

NAME: _____

NAME: _____

ADDRESS: _____

ADDRESS: _____

REPRESENTATIVE: _____

OWNER CONTACT: _____

LICENSE NO.: _____

TELEPHONE: _____

TELEPHONE: _____

MONITORING ENTITY

APPROVING AGENCY

CONTACT: _____

CONTACT: _____

TELEPHONE: _____

TELEPHONE: _____

MONITORING ACCOUNT REF. NO.: _____

TYPE TRANSMISSION

- ☐]-McCulloh
- ☐]-Multiplex
- ☐]-Digital
- ☐]-Reverse Priority
- ☐]-RF
- ☐]-Other (Specify)

SERVICE

- ☐]-Weekly
- ☐]-Monthly
- ☐]-Quarterly
- ☐]-Semiannually
- ☐]-Annually
- ☐]-Other (Specify)

PANEL MANUFACTURER: _____

MODEL NO.: _____

CIRCUIT STYLES: _____

NO. OF CIRCUITS: _____

SOFTWARE REV: _____

LAST DATE SYSTEM HAD ANY SERVICE PERFORMED: _____

LAST DATE THAT ANY SOFTWARE OR CONFIGURATION WAS REVISED: _____

ALARM-INITIATING DEVICES AND CIRCUIT INFORMATION

QTY OF

CIRCUIT STYLE

MANUAL STATIONS
ION DETECTORS
PHOTO DETECTORS
DUCT DETECTORS
HEAT DETECTORS
WATERFLOW SWITCHES
SUPERVISORY SWITCHES
OTHER (SPECIFY): _____

Figure 7-5.2.2 Inspection and Testing Form. 1996 Edition

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DIVISION 16
SECTION 16899

ELECTRICAL
FIRE ALARM SYSTEM INSPECTION AND TESTING FORM

NATIONAL FIRE ALARM CODE

ALARM NOTIFICATION APPLIANCES AND CIRCUIT INFORMATION

QTY OF

CIRCUIT STYLE

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

BELLS
HORNS
CHIMES
STROBES
SPEAKERS
OTHER (SPECIFY): _____

NO. OF ALARM INDICATING CIRCUITS: _____

ARE CIRCUITS SUPERVISED? [] YES [] NO

SUPERVISORY SIGNAL-INITIATING DEVICES AND CIRCUIT INFORMATION

QTY OF

CIRCUIT STYLE

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

BUILDING TEMP.
SITE WATER TEMP.
SITE WATER LEVEL
FIRE PUMP POWER
FIRE PUMP RUNNING
FIRE PUMP AUTO POSITION
FIRE PUMP OR PUMP CONTROLLER TROUBLE
FIRE PUMP RUNNING
GENERATOR IN AUTO POSITION
GENERATOR OR CONTROLLER TROUBLE
SWITCH TRANSFER
GENERATOR ENGINE RUNNING
OTHER: _____

SIGNALING LINE CIRCUITS

Quantity and style (See NFPA 72, Table 3-6) of signaling line circuits connected to system:

Quantity _____ Style(s) _____

SYSTEM POWER SUPPLIES

- a. Primary (Main): Nominal Voltage _____, Amps _____
Overcurrent Protection: Type _____, Amps _____
Location (Panel Number): _____
Disconnecting Means Location: _____
- b. Secondary (Standby): _____
Storage Battery: Amp-Hr. Rating _____
Calculated capacity to operate system, in hours: _____ 24 _____ 60 _____
Engine-driven generator dedicated to fire alarm system: _____
Location of fuel storage: _____

TYPE BATTERY

- [] Dry Cell
[] Nickel-Cadmium
[] Sealed Lead-Acid
[] Lead-Acid
[] Other (Specify) _____

- c. Emergency or standby system used as a backup to primary power supply, instead of using a secondary power supply:

_____ Emergency system described in NFPA 70, Article 700
_____ Legally required standby described in NFPA 70, Article 701
_____ Optional standby system described in NFPA 70, Article 702, which also meets the performance requirements of Article 700 or 701.

Figure 7-5.2.2 Inspection and Testing Form (continued).
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PRIOR TO ANY TESTING

NOTIFICATIONS ARE MADE:

	YES	NO	WHO	TIME
MONITORING ENTITY	[]	[]	_____	_____
BUILDING OCCUPANTS	[]	[]	_____	_____
BUILDING MANAGEMENT	[]	[]	_____	_____
OTHER (SPECIFY)	[]	[]	_____	_____
AHJ (NOTIFIED) OF ANY IMPAIRMENTS	[]	[]	_____	_____

SYSTEM TESTS AND INSPECTIONS

TYPE	VISUAL	FUNCTIONAL	COMMENTS
CONTROL PANEL	[]	[]	_____
INTERFACE EQ.	[]	[]	_____
LAMPS/LEDS	[]	[]	_____
FUSES	[]	[]	_____
PRIMARY POWER SUPPLY	[]	[]	_____
TROUBLE SIGNALS	[]	[]	_____
DISCONNECT SWITCHES	[]	[]	_____
GROUND FAULT MONITORING	[]	[]	_____

SECONDARY POWER

TYPE	VISUAL	FUNCTIONAL	COMMENTS
BATTERY CONDITION	[]	[]	_____
LOAD VOLTAGE	[]	[]	_____
DISCHARGE TEST	[]	[]	_____
CHARGER TEST	[]	[]	_____
SPECIFIC GRAVITY	[]	[]	_____
TRANSIENT SUPPRESSORS	[]	[]	_____
REMOTE ANNUNCIATORS	[]	[]	_____
NOTIFICATION APPLIANCES			
AUDIBLE	[]	[]	_____
VISUAL	[]	[]	_____
SPEAKERS	[]	[]	_____
VOICE CLARITY	[]	[]	_____

INITIATING AND SUPERVISORY DEVICE TESTS AND INSPECTIONS

LOC. & S/N	DEVICE TYPE	VISUAL CHECK	FUNCTIONAL TEST	FACTORY SETTING	MEAS. SETTING	PASS	FAIL
_____	_____	[]	[]	_____	_____	[]	[]
_____	_____	[]	[]	_____	_____	[]	[]
_____	_____	[]	[]	_____	_____	[]	[]
_____	_____	[]	[]	_____	_____	[]	[]
_____	_____	[]	[]	_____	_____	[]	[]
_____	_____	[]	[]	_____	_____	[]	[]

COMMENTS: _____

Figure 7-5.2.2 Inspection and Testing Form (continued). 1996 Edition

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NATIONAL FIRE ALARM CODE

EMERGENCY COMMUNICATIONS EQUIPMENT **VISUAL** **FUNCTIONAL** **COMMENTS**

DIVISION 16
SECTION 16899

ELECTRICAL
FIRE ALARM SYSTEM INSPECTION AND TESTING FORM

PHONE SET	[]	[]	_____
PHONE JACKS	[]	[]	_____
OFF-HOOK INDICATOR	[]	[]	_____
AMPLIFIER(S)	[]	[]	_____
tone GENERATOR(S)	[]	[]	_____
CALL-IN SIGNAL	[]	[]	_____
SYSTEM PERFORMANCE	[]	[]	_____

	VISUAL	DEVICE OPERATION	SIMULATED OPERATION
INTERFACE EQUIPMENT			
(SPECIFY)	[]	[]	_____
(SPECIFY)	[]	[]	_____
(SPECIFY)	[]	[]	_____

SPECIAL HAZARD SYSTEMS			
(SPECIFY)	[]	[]	_____
(SPECIFY)	[]	[]	_____
(SPECIFY)	[]	[]	_____

SPECIAL PROCEDURES: _____

COMMENTS: _____

ON/OFF PREMISES MONITORING:	YES	NO	TIME	COMMENTS
ALARM SIGNAL	[]	[]	_____	_____
ALARM RESTORAL	[]	[]	_____	_____
TROUBLE SIGNAL	[]	[]	_____	_____
SUPERVISORY SIGNAL	[]	[]	_____	_____
SUPERVISORY RESTORAL	[]	[]	_____	_____

NOTIFICATIONS THAT TESTING IS COMPLETE:	YES	NO	WHO	TIME
BUILDING MANAGEMENT	[]	[]	_____	_____
MONITORING AGENCY	[]	[]	_____	_____
BUILDING OCCUPANTS	[]	[]	_____	_____
OTHER (SPECIFY)	[]	[]	_____	_____

THE FOLLOWING DID NOT OPERATE CORRECTLY: _____

SYSTEM RESTORED TO NORMAL OPERATION: DATE _____ TIME _____

THIS TESTING WAS PERFORMED IN ACCORDANCE WITH APPLICABLE NFPA STANDARDS.

NAME OF INSPECTOR: _____ DATE: _____ TIME: _____

SIGNATURE: _____

NAME OF OWNER OR REPRESENTATIVE: _____

DATE: _____ TIME: _____

SIGNATURE: _____

Figure 7-5.2.2 Inspection and Testing Form (continued).
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RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

TESTS:

Test all lines to be concealed before burying or covering with new construction. Tests shall include proper operation of lights, receptacles, and equipment, continuity of conduit system, insulation leakage and impedance, elimination of motor single phasing or reverse rotation, and ground system resistance (see also Section 16400).

After the interior wiring system is completed and at such time as the Engineer or Owner's representative may direct, the Contractor shall conduct an operating test for approval. The tests shall be performed in the presence of the authorized representative of the Engineer and the installation shall be demonstrated to operate in accordance with the requirements of this specification. The Contractor shall furnish all instruments and personnel required for the test. The Contractor shall have sufficient tools and personnel available at the scheduled inspection to remove panel fronts, device plates, etc., as required for proper inspection of equipment, devices and wiring installation as may be required by the inspectors. Any material or workmanship which does not meet with approval of the engineer shall be promptly removed, repaired or replaced as directed, at no additional cost to the Owner.

ADJUSTMENTS:

Adjustments shall include load balancing of all electrical phases, at devices and panels. Balance all panelboards so that the maximum deviation of any one phase from the average of all the phases shall not exceed 10%. Re-type circuit directory as required after completion of adjustment.

CLEANING AND PAINTING:

Prior to final inspection, all equipment having factory finishes shall be thoroughly cleaned inside and outside. All damaged surfaces shall be replaced or refinished by Contractor, with paint same as original manufacturer. Engineer shall determine whether the damaged surface is to be replaced or painted.

RECORD DRAWINGS:

The Contractor shall maintain accurate records of all deviations in work as actually installed from work indicated on the drawings. On completion of the project, two (2) complete sets of marked-up prints shall be delivered to the Architect.

OPERATING AND MAINTENANCE INSTRUCTIONS:

Unless directed otherwise elsewhere in these specifications, the Contractor shall compile and bind three sets of all manufacturer's instructions and descriptive literature on all items of equipment furnished under this work. These instructions shall be delivered to the Engineer for approval prior to final inspection. Instructions shall include operating and testing procedures and a parts list of all equipment. The Contractor shall instruct the Owner's personnel in the proper operation of all systems and equipment. The front and side of the binder shall be titled "Electrical Operating and Maintenance Instructions", with name of the job and firm name of the Contractor.

WARRANTY:

The Contractor shall submit upon completion of the work, a warranty by his acceptance of the contract, that all work installed will be free from defects in workmanship and materials. If, during the period of one year, or as otherwise specified from date of Certificate of Completion and acceptance of work, any such defects in

workmanship, materials, or performance appear, the Contractor shall, without cost to the Owner, remedy such defects within reasonable time to be specified in notice from the Architect. In default, the Owner may have such work done and charge cost to Contractor.

END OF SECTION

END OF SPECIFICATIONS

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

SCOPE OF WORK:

The scope of work consists of the furnishing and installing all materials, labor, and equipment required for the existing Low Voltage systems (Voice, Data, Intercom, Security and Door Access Control) as indicated on the plans for complete and operational systems including other interconnected Low Voltage systems. The Technology Contractor (hereafter referred to as "the Contractor", or Technology Contractor) shall verify and certify that the systems are complete and functioning properly (Existing and/or New). The Contractor shall note that all items of equipment are specified in the singular; however, the Contractor shall provide and install the number of items of equipment as indicated on the drawings and as required for complete systems.

DESCRIPTION OF WORK:

It is the purpose of this specification to require the furnishing of the highest quality materials, equipment, and workmanship available, to fulfill the requirements of the work specified herein.

The Technology Systems encompass the Voice/Data Network Systems, and Intercom, as specified in Division 17. The Technology System shall provide a Telephone, Classroom and Administrative Intercommunication System, and a collapsed Fiber Optic Backbone / Cat 6 Ethernet Data Infrastructure. Other Low Voltage systems shall provide HVAC scheduling via a master time clock, door access control, security camera recording and notification of break-ins according to the counties standard operational procedure. Work Included as follows:

1. The work consists of providing all labor, equipment, supplies, materials, and incidentals and in performing all operations necessary for the "TURNKEY", fully operational, and completed work for the expansion of the existing Low Voltage Technology Systems, in complete accordance with the Contract Documents.
2. The base bid work shall include, but not be limited to, the following:
 - a. Provide all appropriate licenses for system as installed
 - b. Coordination of the Raceway installation with Division 16 Contractor
 - c. Furnish and Install specified data network system
 - d. Furnish and Install all PA and Sound Intercommunication Systems. Dedicated local sound systems for Auditoriums, Gymnasiums and Cafeterias shall be provided in the electrical contract, i.e. not provided within the scope of this contract, but requires coordination and inter-connection by this contractor.
 - e. Furnish and Install the VOIP Telephone equipment compatible with the existing System.
 - f. Provide product demonstrations as required by the Owner
 - g. Coordination with General Contractor, and all other trades.

3. Technology systems shall be bid as part of the Construction Contract.

It is the intention of the Specifications and Drawings to call for finished work, tested and ready for operation.

Any apparatus, appliance, material, or work not shown on the drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered, and installed by the Contractor without additional expenses to the Owner.

Minor details not usually shown or specified, but necessary for proper installation and operation, shall be included in the Contractor's estimate, the same as if herein specified or shown.

With submission of bid, the Contractor shall give written notice to the Architect of any materials or apparatus believed inadequate or unsuitable, in violation of laws, ordinances, rules, and any necessary items or work omitted. In the absence of such written notice, it is mutually agreed that the Contractor has included the cost of all required items in his proposal, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensation.

NOTICE TO BIDDERS, INSTRUCTIONS TO BIDDERS, SUPPLEMENTARY INSTRUCTIONS, GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, SPECIAL CONDITIONS, GENERAL REQUIREMENTS bound in the front of this document are included as a part of the specifications for this work.

DRAWINGS AND SPECIFICATIONS:

These drawings are diagrammatic and indicate the general arrangement of fixtures, equipment, and work included in the contract. Consult the architectural, structural, mechanical and electrical drawings and details for exact location and dimensions of fixtures and equipment; where same are not definitely located, obtain this information from the Architect.

The Contractor shall follow drawings in laying out work and check drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, the Architect shall be notified before proceeding with installation. If directed by the Architect, the Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

The plans and these specifications are intended to describe, imply and convey the materials and equipment as well as necessary labor, required for the installation as outlined in the paragraph entitled "Scope of Work". Any omissions from either the drawings or these specifications are unintentional, and it shall be the responsibility of the Contractor to call to the attention of the Architect or Engineer any pertinent omissions before submission of a bid. The drawings which accompany these specifications are not intended to show in complete detail every fitting which may be required; however wherever reasonable implied by the nature of the work, any such material or equipment shall be installed by this Contractor as a part of his contract price. In no case will any extra charge be allowed unless authorized in writing by the Architect or Engineer.

The Contractor shall arrange with the General Contractor for required concrete and masonry chases, openings, and sub-bases so as not to delay progress of work. Work shall be installed sufficiently in advance of other construction to conceal piping and to permit work to be built in where required.

WORK SCHEDULE:

The contractor will coordinate all work schedules with the General Contractor and/or Architect. All efforts should be made to complete cable installation prior to the installation of ceiling tile in new or modernized construction.

DEFINITIONS:

It shall be understood and agreed by all parties that where the following terms appear, these definitions apply:

"Furnish" - to supply or give.

"Install" - to place, establish or fix in position.

"Provide" - to furnish and install as defined above.

The term "Bidder" refers to those parties who are submitting proposals for the work set forth in this document.

The term "Contractor" refers to the successful Bidder and to any work or issues after the award of the contract.

The term "Owner" refers to the County School System or its designated agent.

GENERAL REFERENCE STANDARDS:

The installation shall comply with the following:

1. NFPA No. 70 National Electric Code (NEC), Current Edition
2. State and Local Building codes
3. National Fire Protection Agency (NFPA) No. 101, Life Safety Code, latest Edition
4. UL Directory of Electrical Construction Materials
5. BICSI Telecommunications Distribution Methods Manual

The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings (in addition to contract drawing and documents) in order to comply with all applicable laws, ordinances, rules, and regulations, whether or not shown on drawings and / or specified.

All work and materials under this section shall be in strict compliance with more stringent requirements of the North Carolina State Building Code, including the National Electrical Code, NFPA 101-Life Safety Code, Regulations of the State Fire Marshall, and requirements of the local utility company

STANDARD FOR MATERIALS:

Furnish and install new and undamaged materials conforming to the applicable standard. The standards and publications of the following entities and applicable to materials specified herein:

1. Underwriters Laboratories (UL)

2. Institute of Electrical and Electronic Engineers (IEEE)
3. American National Standards Institute (ANSI)
4. Electronics Industry Association (EIA)
5. Telecommunications Industry Association
6. Electronics Testing Laboratories, Inc. (ETL)

Materials referenced by manufacturer or trade name are cited for the quality of the product and are not intended to limit competitive bidding. The Bidder, at their option, may bid to furnish alternative products which are equal in quality and performance; however, all substitutions must be approved by Owner.

PERMITS AND FEES:

The Contractor shall give all necessary notices, including electric and telephone utilities, obtain all permits, and pay all government taxes, fees, and other costs, including utility connections or extensions in connection with his work file all necessary plans, prepare all documents, and obtain all necessary approvals of all governmental departments having jurisdiction at each phase of construction as required; obtain all required certificates of inspection for his work and deliver same to the Architect before request for acceptance and final payment for the work.

FCC APPROVAL:

The system shall be approved for direct interconnection to the telephone utility under Part 68 of FCC rules and regulations. Systems which are not FCC approved or utilized and intermediary device for connection shall not be considered. Provide the FCC registration number of the system being proposed as a part of the proposal process.

PRODUCT DEMONSTRATIONS:

The Systems Contractor may be required to provide product demonstrations and interviews with the Owner and his representatives or may be required to provide side-by-side demonstrations with other vendors. These demonstrations may be required before a contract is issued. Contractors should be prepared to demonstrate each feature called for in these specifications.

VERIFICATION OF DIMENSIONS, DETAILS, EXISTING FIELD CONDITIONS:

The Contractor shall visit the premises prior to bidding, and thoroughly familiarize himself with all details of the work, working conditions, verify dimensions in the field, provide advice of any discrepancy, and submit shop drawings of any changes he proposes to make in quadruplicate for approval before starting any work. The Contractor shall install all equipment in a manner to avoid building interference.

Telephone Equipment

New equipment shall be fully compatible with the existing system. Field verify exact phone required for the existing system.

For reference: Current school system standard materials for telephone systems includes YEALINK IP Office Communication Manager Latest Release, with telephony components, data networking capability and WAN interface as shall meet minimum functionality required within these specifications. Telephones and handsets shall be YEALINK products for VoIP applications.

Telephones for classrooms, resource and teacher workrooms shall be YEALINK T40P, quantity as required for one device at each location.

Telephones in the Administration Area, Media center (including ancillary rooms) shall be YEALINK T42G, quantity as required for one device at each outlet location.

Provide one YEALINK T48G telephone at Administration Area secretary location.

SHOP DRAWINGS:

The Contractor shall submit a minimum of five (5) copies of the shop drawings to the Architect for approval within thirty (30) days after the award of the general contract. If such a schedule cannot be met, the Contractor may request in writing for an extension of time to the Architect. If the Contractor does not submit shop drawings in the prescribed time, the Architect has the right to select the equipment.

Provide manufacturer's cuts of items to be provided under this Contract. The shop drawings shall be neatly bound in five (5) sets and submitted to the Architect with a letter of transmittal. The letter of transmittal shall list each item submitted along with the manufacturer's name.

Approval rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are approved, said approval does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawings and specifications.

SUBMITTALS:

A. Prior to proceeding with the work:

A complete schedule of ALL equipment and materials which are to be furnished for the work. Accompanying the schedule shall be manufacturer's specification or cut sheets for all major components listed in Section 2 of this specification.

1. Shop Drawings

Complete shop drawings for all systems and assemblies specified. Each drawing shall have a descriptive title and all subparts of each drawing shall be labeled. All drawings shall have the name and location of the project and the Systems Contractor's name in the title block.

2. Cabinets & Assemblies

Complete scaled drawings of all equipment racks, consoles, special assemblies, etc. Each drawing shall show all equipment with its manufacturer and model number.

3. Device Locations

Complete scaled drawings detailing installation locations of all equipment, such as control panels, plug panels, TV monitors, equipment racks, speakers, etc. All conduits with cable quantities and types and all terminal block locations shall also be indicated.

4. Device Layout

Complete scaled drawings detailing all device plates, plug panels, input/output panels, rack panels and custom components to be fabricated by the Systems Contractor. Include the same details for all custom or non-standard components to

be furnished by vendor/manufacturers of the Systems Contractor. Show all connectors, mounting devices and engraving detail on these drawings.

5. System Diagrams

Detailed one line drawing of all systems. Each system drawing shall detail the field wiring and wiring within racks, consoles, control panels, devices, speaker assemblies, etc. Each drawing shall show proposed (and eventually as built) circuit numbers for all cables and terminal connections. Provide typical wiring termination details for all devices.

6. Systems Contractor job references and key employee résumés, as described in the Contractor Qualifications portion of this specification.

C. Prior to proceeding with respective portions of work:

1. Diagrams for AC power low voltage control switching.
2. Details and descriptions of any other aspect of the system which differ from the contract drawings due to field conditions or due to the equipment furnished.
3. Submittal as otherwise noted on the drawings and/or as noted herein.
7. Approved shop drawings and instruction brochures, including schematic diagrams for all electronic devices, shall be present at the job site during the period set aside for system testing.
8. Notebooks of operating instructions shall be prepared for the Owner as described herein.

C. At Project Completion

1. As-Builts

Prior to final acceptance, provide three complete sets of drawings showing all cable numbers and construction details in accordance with the actual system installation. Revise all shop drawings to represent actual installation conditions.

2. Operation and Maintenance Manuals

Prior to final acceptance, provide three complete sets of operation and maintenance manuals for the system. The operation manual shall contain all instruction necessary for the proper operation of the installed system and manufacturers' instruction. The maintenance manual shall contain all "proof of performance" information as required in Section 3, and all manufacturers' maintenance information, and copies of non-priority computer programs and system set up disks documenting all programmable features for the installed system.

COORDINATION WITH OTHER TRADES:

Coordinate all work required under this section with work of other sections of the specifications to avoid interference. Bidders are cautioned to check their equipment against space available as indicated on drawings, and shall make sure that proposed equipment can be accommodated. If interferences occur, Contractor shall bring them to attention in writing, prior to signing of contract; or, Contractor shall at his own expense provide proper materials, equipment, and labor to correct any damage due to defects in his work caused by such interference.

INSPECTION AND CERTIFICATES:

On the completion of the entire installation, the approval of the Architect and Owner shall be secured, covering the installation throughout. The Contractor shall obtain and pay for Certificate of Approval from the public authorities having jurisdiction. A final inspection certificate shall be submitted to the Architect prior to final payment. Any and all costs incurred for fees shall be paid by the Contractor.

EQUIVALENTS:

When material or equipment is mentioned by name, it shall form the basis of the Contract. When approved by the Architect in writing, other material and equipment may be used in place of those specified, but written application for such substitutions shall be made to the Architect as described in the Bidding Documents. The difference in cost of substitute material or equipment shall be given when making such request. Approval of substitute is, of course, contingent on same meeting specified requirements and being of such design and dimensions as to comply with space requirements.

CUTTING AND PATCHING:

On new work, the Contractor shall furnish sketches to the General Contractor showing the locations and sizes of all openings and chases, and furnish and locate all sleeves and inserts required for the installation of the electrical work before the walls, floors, and roof are built. This Contractor shall be responsible for the cost of cutting and patching where any items were not installed or where incorrectly sized or located. See also Section 01050.

CONTRACTOR QUALIFICATIONS:

- A. The Contractor or subcontractor must be a "Systems Contractor" who has been regularly engaged in the furnishing and installation of commercial and industrial sound, communications and telephone systems and related visual communications systems for a period of at least the last three (3) years and who can show evidence of successfully completing, with its present staff, at least three (3) projects of similar size and scope, including the media management addition. The Systems Contractor, not its employees, must meet these contractor qualifications. With the proposal, provide a list of jobs completed, with contact, address and phone number and the A/V Contractors key employees assigned to the project, listing their responsibilities during the job and the length of time with the contractor in this capacity.
- B. The Systems Contractor shall demonstrate to the satisfaction of the Architect/Engineer and Owner that it has:
 - 1. Adequate plant and equipment to pursue the work properly and expeditiously.
 - 2. Adequate staff and technical experience to implement the work.
 - 3. Suitable financial status to meet the obligations of the work.
 - 4. Technically capable and factory trained service personnel at a contractor owned service facility within one hundred (100) mile radius of the project site, to provide routine and emergency service for all products used in the project.
- C. The Systems Contractor shall:
 - 1. Be bondable.

2. Hold a SPLV Contractors License which is accepted as valid within the State of North Carolina.
 3. Be a factory authorized sales and installation contractor for all products used in the project.
- D. Any contractor, who intends to submit a proposal for this work and does not meet the requirements of the "Contractor Qualifications" paragraph(s) above, shall employ the services of a "Systems Contractor" who does meet the requirements and who shall furnish the equipment, shop fabricate the equipment racks and subassemblies, make all connections to equipment and equipment racks, make all connections to remote controls and connection panels, and continuously supervise the installation and connections of all system cable and equipment.
- E. A subcontractor so employed as the "Systems Contractor" shall be acceptable to the Owner and/or Architect/Engineer and shall be identified in the proposal.

QUALITY ASSURANCE:

A. General

All equipment and materials required for installation under these specifications shall be new (less than 1 year from date of manufacture) and without blemish or defect.

B. Specific

Each major component of equipment shall have the manufacturer's name, address and model number on a plate securely affixed in a conspicuous place. NEMA code ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be easily visible.

C. Substitutions

It is not the intent of these specifications to limit or restrict submission of proposals for products by other manufacturers but to set a baseline of operational performance and functions which all bidders must meet.

- D. Where a specific piece of equipment has been discontinued and/or replaced by a new model, submission of the new model does not guarantee acceptance. Substitute items shall require evaluation by the Architect/Engineer, Owner or their agent prior to acceptance.
- E. If substitute equipment is allowed even by an approved submittal, the ITS Contractor shall be completely responsible for its use and for its ability to fulfill all intended functions in the completed systems. The ITS Contractor shall replace all such equipment with equipment listed by type and model number in the specifications if there is any evidence of equipment instability and/or incompatibility.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

SCOPE OF WORK:

This document provides specifications to be used in conjunction with network design drawings for installation of voice and for data cabling.

The Contractor shall furnish all labor, materials, tools, equipment and services necessary for and reasonably incidental to installation of specific voice and/or data cabling communications infrastructure. Work shall include all components for both a voice and data horizontal and riser cable plant from workstation outlet termination to wire closet termination. All cable plant components such as outlets, wiring termination blocks, racks, patch cables, etc. will be furnished, installed, and tested by the Contractor. The data cable plant is designed to support a 10BASE-T Ethernet building-wide computer network.

The scope of work includes all activities needed to complete the wiring and network intelligent hub equipment installation described in this document and the drawings.

The successful Bidder must be able to provide and install new equipment and materials in compliance with specifications contained in this document and accompanying drawings.

Any and all overtime (outside school hours) required to complete the scope of work within the time frame specified shall be included in the quoted price.

VOICE AND DATA WIRING PLAN OVERVIEW:

The cable system is based on the universal cabling concept. The same cables are installed to all workstations; connectors, adapters, and interconnections determine how the cable operates.

COMMUNICATIONS DESIGN (CD) DRAWINGS:

Communications design drawings show voice and data CNO locations, cable routing, and wire closet layout plans.

WORK SCHEDULE:

The contractor will coordinate all work schedules with the Architect. All efforts should be made to complete cable installation prior to the installation of ceiling tile in new or modernized construction.

DEFINITIONS:

The term "Bidder" refers to those parties who are submitting proposals for the work set forth in this document. The term "Contractor" refers to the successful Bidder and to any work or issues after the award of the contract.

The term "Owner" refers to County Schools IT personnel or its designated agent.

A "Communications Network Outlet" (CNO) refers to a specific communications termination location with "two or four port communications outlet", defined as a CNO containing 2 or 4 modular RJ-45 connectors. A "jack" refers to one modular RJ-45 connector. A "faceplate" is a decorative cover that covers the non-exposed portion of the jack and attaches to the outlet.

“Riser” refers to the cables interconnecting the wiring closets. Please note that in most cases the riser cables are physically a horizontal run between two closets.

GENERAL REFERENCE STANDARDS:

The installation shall comply with the following:

1. National Fire Protection Agency (NFPA) No.70, National Electric Code 2005 Edition
2. State and Local Building codes
3. National Fire Protection Agency (NFPA) No. 101, Life Safety Code, latest edition.
4. TIA/EIA 568A, 568B, 606, 607, and 569.
5. Building Industry Consulting Service International's (BICSI) Telecommunications Distribution Methods Manual

CONSTRUCTION SUBMITTAL:

In addition to the submittal requirements the Contractor must submit the following information during the execution of the project.

1. The Contractor must submit the manufacturer and model number for all suggested substitution of equipment specified for the work contracted. The Owner will determine acceptability of equipment at their discretion. For all cable components, the Owner will require certification that components are accepted for use in Ethernet networks, and meet all specifications as described.
2. The Contractor shall submit for approval samples of voice and data cable, fiber optic cable, patch cords, patch panels, faceplates and jacks. Samples shall be returned upon written request. The Owner shall have the right to reject any submittal that does not meet the specifications and intended use as determined by Owner.
3. Shop drawings showing proposed cable routing, closet detail design, rack design, MDF layout and other design details not specified in this document or Communications Design Drawings shall be submitted prior to any portion of the system installation for approval and to demonstrate compliance with the contract documents. Any departures from the original contract drawings should show details of such departures including changes in related portions of the project and the reasons therefore submitted with the shop drawings. Shop drawings must be provided showing details of all proposed fire-stops for four-hour rated walls. Approved departures recommended by the Contractor shall be made at no additional cost to Owner or shall result in a net decrease in cost. The Owner shall obtain the benefits of any cost reductions of these changes.
4. The Contractor shall submit as-built design drawings of the installed cable system including any design which deviates from the specified routes. As-built drawings shall include cable routes and labeling, patch panel configurations, IDC and MDF configurations, cross connect details, riser system, patch cord details, riser system, fiber storage and labeling. As-builts shall be turned over to the Owner as each section of the work is completed.

PART 2: PRODUCTS

STANDARD FOR MATERIALS:

Furnish and install new and undamaged materials conforming to the applicable standard. The standards and publications of the following entities and applicable to materials specified herein:

1. Underwriters Laboratories (UL)
2. Institute of Electrical and Electronic Engineers (IEEE)
3. American National Standards Institute (ANSI)
4. Electronics Industry Association (EIA)
5. Telecommunications Industry Association
6. Electronics Testing Laboratories, Inc. (ETL)

Materials referenced by manufacturer or trade name are cited for the quality of the product and are not intended to limit competitive bidding. The Bidder, at their option, may bid to furnish alternative products which are equal in quality and performance; however, all substitutions must be approved by Owner.

COMPLETENESS OF WORK:

Furnish all material, labor, transportation, tools, equipment, and supervision to install and leave ready for operation a complete communications systems in accordance with these specifications and the accompanying drawings.

All offsets, bends fittings pull boxes, stems and supports for the complete installation are not indicated on the drawings. It shall be the Contractor's responsibility to furnish and install all offsets, bends, devices, raceway supports, and equipment for the complete installation.

COMPATIBILITY:

Provide products which are compatible with other components in the system with which they must interface. Components and materials must fit into the confines indicated, leaving adequate clearance as required by applicable codes or manufacturer for adjustment, repair, or replacement.

PRODUCT HANDLING, DELIVERY, STORAGE:

Ensure that all system equipment, devices, and materials arrive at the designated installation site in good condition, intact in factory package or crate. Any equipment found to be damaged will be removed from the project site and will be replaced by the Contractor at their expense.

Storage - Store all equipment, devices and materials in their factory containers or package until ready for use. Storage facilities will be a clean, dry and indoor space which provides protection against the weather. Avoid damage by condensation by providing temporary heating when required. Large reels of cable may be stored outdoors provided there is adequate protection from physical damage and the cable ends are properly sealed to prevent moisture ingress. The Bidder shall state how much space and floor loading will

be required. Storage related costs will be the responsibility of the Contractor. Coordinate all storage of materials and equipment with the Owner.

Handling - Handle all equipment, devices and materials carefully to prevent breakage, denting or scoring of the finish or cable jackets. Damaged materials will be removed from the project site, and replaced by the Contractor at no additional cost. No sheath cuts will be accepted. All cables must be installed with sheath intact to the point of termination.

The Bidders should note that strict limitations will be enforced on the size, weight, and arrangement of cable reels. In general, cable reels must be of a size to be lifted on the interior freight elevator, and fit through standard doorways.

Any cable found to be damaged or defective shall be replaced by the Contractor at no additional cost to the Owner.

DATA CABLE INFRASTRUCTURE

A. Twisted Pair Cable

1. Cabling shall be unshielded twisted pair (UTP) and shall meet EIA/TIA-568, TSB-36 requirements for Category 6 (Security/Cameras, HVAC Controllers, and Data Port Drops) 6A (Wireless Access Points and Access Door Control). Provide UTP cable with the following minimum features:
 - a. Conductors: 24 AWG solid copper, 4 pair;
 - b. Impedance: 100 ohms +/-15% at 1-100 MHz;
 - c. DC Resistance: 25.7 ohms/1000 ft. maximum at 20 degrees C;
 - d. Mutual Capacitance: 14 pF/ft. nominal at 1 MHz;
 - e. Attenuation (per 1000 ft):
 - i. 2.0 dB at 1 MHz
 - ii. 3.7 dB at 4 MHz
 - iii. 6.0 dB at 10 MHz
 - iv. 7.6 dB at 16 MHz
 - v. 8.6 dB at 20 MHz
 - vi. 10.8 dB at 31.25 MHz
 - vii. 15.5 dB at 62.5 MHz
 - viii. 20.2 dB at 100 MHz
 - ix. 25.8 dB at 155 MHz
 - x. 29.8 dB at 200 MHz
 - xi. 41.2 dB at 300 MHz

2. Provide one "homerun" UTP cable between each data outlet port indicated on the drawings and the appropriate Local 100/1000 Switch
3. UTP cables shall not exceed 90 meters from the data outlet port to the appropriate 100/1000 Switch
4. Provide cable sheathing in the following color schemes:
 - Security/Cameras: Yellow
 - Data: Blue
 - Patch Cables: Blue
 - HVAC Controls: Purple
 - Wireless Access: Blue
 - Door Access Control: Yellow
 - Intercom: White
 - Fire Alarm: Red

D. Data Station Outlet

1. Face plates

- a. Provide Data Station Outlets as indicated on the drawings with the following features:
 - i. Single gang, flush mountable, stainless steel construction;
 - ii. Shall accept data, telephone, fiber optic, VGA, video, audio and blank insert modules;
 - iii. Shall have the capability to accept up to six individual ports;
 - iv. Inserts shall snap in and out from the front of the Data Station Outlet;
 - v. Face plates shall be supplied with pressure-sensitive icon labels;

2. Inserts

- a. Provide Data Port inserts with the following features:
 - i. RJ-45 type rated for Category 6;
 - ii. RJ-45 insert shall be configured to EIA-568A wiring standards;
 - iii. Attenuation through the RJ-45 port at 10/16 MHz shall be less than .015/.025 dB;
 - iv. Provide 110 style IDC terminations for all eight conductors of a UTP cable;
- b. Provide Telephone Inserts with the following features:
 - i. RJ-45 type rated for Category 6;
 - ii. RJ-45 insert shall be configured to USOC wiring standards;
 - iii. Provide 110 style IDC terminations for all six conductors of a UTP phone cable;

- c. Provide HDMI & Data inserts with the following features for all new wall mounted Monitors and Teacher's Stations:
 - i. Premanufactured HDMI Cables and inserts
 - ii. RJ-45 type rated for Category 6;

E. Patch Panels

1. Patch panels shall be provided at each new IDF room and/or switch closet for termination of all UTP and fiber optic cables. Patch panels shall have the following features:
2. Patch Panels for Twisted Pair Cable
 - a. Panels shall be mountable in EIA standard 19" equipment racks;
 - b. Panels shall be rated for Category 6;
 - c. Each panel shall provide a minimum of twenty-four RJ-45 ports in one rack space position (1RU);
 - d. Each RJ-45 port shall provide 110 style IDC terminations for all eight conductors of a UTP cable;
 - e. RJ-45 ports shall be configured to EIA-568A wiring standards;
 - f. Attenuation through the RJ-45 port at 10/16 MHz shall be .015/.025 dB;
 - g. Clearly label each patch point with the location of its associated data station port;
3. Provide a three (3) foot minimum Category 6 UTP patch cable for every Category 6 UTP data cable terminated at a patch panel. Install and neatly route patch cables between the panel and the hubs utilizing cable management hardware.
4. Patch Panels for Fiber Optic Cables
 - a. Panels shall be mountable in EIA standard 19" equipment racks;
 - b. Panels shall provide LC-LC feed-through connectors for termination of fiber optic strands;
 - c. Panels shall provide space for at least three feet of fiber optic cable management and excess patch cable storage in a pull-out drawer;
 - d. Clearly label each fiber optic LC patch position with the location of its origin;
5. Provide a 6-foot minimum fiber optic patch cable for every fiber hub or switch port in the system. Install and neatly route patch cables between the panel and the hubs, utilizing cable management hardware.
6. Provide horizontal cable management panels between each patch panel for twisted pair cable and vertical cable management panels for each data rack. Cable management panels shall be Panduit "WMP" series, or equal.

7. Provide fiber management systems at the panel location.
- F. Ethernet Switch at IDF and Switch Closet Locations or as shown on the drawings
- G. Certification
 1. Systems Contractor shall be factory certified to install the Data Cabling Infrastructure. The Systems Contractor shall include a copy of the factory-provided certification with his submittal.

PART 3: EXECUTION

Perform the work in accordance with acknowledged industry and professional standards and practices, and the procedures specified herein. Furnish and install all materials, devices, components, and equipment for complete operational systems.

DEVIATIONS:

No deviations shall be made from the drawings or specifications. Should the Contractor find at any time during the progress of the work, that in his judgement, conditions made desirable or necessary modifications in the requirements covering any particular item or items, he shall report such matters promptly to the Owner for his decision and instruction.

COOPERATION BETWEEN TRADES:

The communications work shall be scheduled with the work of the other trades to avoid delays, interference's, and unnecessary work. All other shall be notified of all openings, hangers, excavations and similar operations for the installation of communications work, is required under this section of the specifications. The work of other trades shall not be cut without first consulting the Owner. Any work damaged by those employed in the work under this section of the specifications shall be repaired using the services of the trade whose work is damaged at the cost of the Contractor.

The plans are diagrammatic and reference must be made to structural, architectural, and mechanical systems plans and actual construction. Work under this section shall be coordinated with the different trades so that interference between electrical raceways, piping, equipment, architectural, and structural work shall be avoided.

Clearly and completely specify all items and actions relative to the installation and operation of the proposed equipment that the Owner will be responsible for providing and/or performing.

The successful Bidder's project manager will be responsible for providing written reports to the Owner at the beginning of every week for the previous week's work completed and upcoming week's planned. Maintain a competent supervisor and supporting technical personnel, acceptable to the Owner, during the entire installation. Change of the supervisor during the project shall not be acceptable without prior written approval from the Architects.

Dress and permanently label all cables at each end using approved labels to ensure a neat and organized appearance.

Do not splice or otherwise re-terminate any cable used to fulfill the requirements of this specification other than at the main distribution frame and intermediate distribution cabinet. Riser cables will not contain intermediate splices.

Coordinate work with any other communications parties on-site, specifically, the LAN Installer, the Computer Installer, and other third parties whose work may affect or be affected by the cabling systems described herein.

During installation, the Owner and/or Representative will conduct periodic inspections to verify that cable installation is proceeding according to the guidelines specified in this document. Any deficiencies found will be properly corrected within 7 days by the Contractor at no additional expense to the Owner upon notification to the Contractor.

It is expected that overtime may be required to complete the scope of work in the time allocated. The Bidder must include all overtime in his price and no additional overtime charges will be accepted.

The Contractor will control litter at all times by keeping it in containers. The Contractor will remove any installation debris from the site and dispose of it properly. Major trash will be removed daily by the Contractor. All other cable-related trash, dust, dirt, etc. must be removed and cleaned prior to acceptance.

INSTALLATION OF SYSTEMS

A. Device Locations

Locate all apparatus requiring adjustments, cleaning, or similar attention so that is shall be accessible for such attention. Equipment racks shall be positioned to permit full access for operation and service.

B. Blank and Custom Panels

Finish of blank panels and custom assembly panels shall match adjacent equipment panels as closely as possible.

C. Markings

Switches, connectors, jacks, receptacles, outlets, cables, and cable terminations shall be logically and permanently marked. Custom panel nomenclature shall be engraved, etched, or screened. Marking for these items are purposely detailed on the drawings to ensure consistency and clarity. Verify any changes in working type size, and/or placement with the Architect prior to marking.

D. Environment

The equipment specified herein is designed to operate in environments of normal humidity, dust, and temperature. Protect equipment and related wiring during installation where extreme environmental conditions can occur.

ELECTRICAL POWER

A. Grounding

Review and coordinate electrical power system installation including grounding, with the Division 16 Prime Contractor to ensure proper operation of the system. All racks, cable tray, and devices shall be grounded to a common isolated grounding bar within each MDF or IDF. Additional grounding shall be installed where directed by the engineer.

B. Verification

Verify that all AC power circuits designated for the system are properly wired, phased, and grounded. Report in writing any discrepancies found to the Division 16 Prime Contractor for corrective action.

C. Equipment Rack

Provide distribution of electrical power within the equipment racks with a minimum of two spare AC receptacles per branch circuit, used in the racks. ICS Contractor shall provide and install 20 amp power strips in each data rack.

CLEANING

Clean all junction and terminal box interiors thoroughly before installing plates, panels, or covers.

WIRING METHODS & PRACTICES

A. Identification

All wires shall be permanently identified at each wire by marking with "E-Z" tape marker or equivalent.

B. Terminal Blocks

All terminal block connections shall be readily accessible. Not more than two wires connected to one terminal. Spare terminal blocks, equivalent to 10% of those in actual use shall be provided.

C. Splicing

Splicing of cables shall not be permitted between terminations of specified equipment.

D. Pulling Cable

Do not pull wire or cable through any box fitting or enclosure where change of raceway alignment or direction occurs. Do not bend conductors to less than recommended radius. Employ temporary guides, sheaves, rollers, and other necessary items to protect cables from excess tension, abrasion, or damaging bending during installation. All cables not in conduit shall be installed in J Hooks spaced no more than 5 feet apart.

E. Cable Tie

Form in a neat and orderly manner all conductors in enclosures and boxes, wire ways, and wiring troughs, providing circuit and conductor identification. Tie as required using T & B "Ty-Raps" (or equivalent) of appropriate size and type. Limit Spacing between ties to six inches and provide circuit and conductor identification at least once in each enclosure.

F. Service Loops

Provide ample service loops at each termination so that plates, panels, and equipment can be demounted for service and inspection.

G. Wiring Harnesses

1. All wires and cables used in assembling custom panels and equipment racks shall be formed into harnesses which are tied and supported in accordance with accepted Engineering practice.

2. Harnessed cables shall be formed in either a vertical or horizontal relationship to equipment, controls, components, or terminations.

EQUIPMENT RACKS

A. General

The equipment racks shall be considered as custom assemblies and shall be assembled, wired, and tested in a properly equipped shop maintained by the ICS Contractor. Assembly of racks on site shall not be permitted. Racks shall be B-Line model SB556084X-UFB or equal. Data closets shall have 18" B Line (or equal) ladder tray installed to allow for adequate cable support and service loops.

B. Equipment Location

Placement of equipment in equipment racks, as indicated in the drawings, is for maximum operator convenience. Verify any changes in placement prior to assembly. All system components and related wiring shall be located with due regard for the minimization of induced electromagnetic and electrostatics noise, for the minimization of wiring length, for proper ventilation, and to provide reasonable safety and convenience for the operator.

C. Rack Installation

Racks shall be installed plumb and square without twists in the frames or variations in level between adjacent racks.

D. Identification

All terminal blocks, rack mounted equipment, and active slots of card frame systems shall be clearly and logically labeled as to their function, circuit, or system as appropriate. Labeling on manufactured equipment shall be engraved plastic laminate with white lettering on black or dark background that is similar to panel finish.

PART 4: TESTING

TOOLS AND TEST EQUIPMENT

The Contractor will provide all tools and test equipment required for installation and testing work. Test equipment will be maintained in accurate calibration and will display the dates of the last calibration and next scheduled calibration. The Contractor is responsible for performing all tests indicated at the end of each section.

For all tests, the Owner or its agent must be present at the beginning of testing and at such times as the owner deems appropriate. The Contractor shall be responsible for correcting any problems or defects discovered during testing.

DATA CABLE INFRASTRUCTURE TESTING

1. Test each twisted pair cable segment (example: from the data station port through the patch bay and patch cable to the hub port connector). Publish a log of each test to verify that the cable segment passes the EIA/TIA-568 TEB-36 requirements for Category 6 compliance. Bind the test log in a booklet and turn the booklet over to the Owner. The test shall include:
 - a. Connector/cable continuity – line mapping;

- b. Cable segment length;
 - c. Dual near end cross talk (NEXT);
 - d. Attenuation at 100 MHz;
 - e. Attenuation per foot;
 - f. Pass/fail results of each portion of the test above.
- 2. Test each fiber optic strand segment (From each classroom or switch location to the MDF). Publish a log of each test to verify that the fiber segment passes the EIA/TIA-526-14 optical power loss measurement test. Bind the test log in a booklet and turn the booklet over to the Owner.

PART 5: COMMISSIONING

SYSTEM DOCUMENTATION

- A. Prior to final acceptance tests, submit to the Architect, three copies of an operating and maintenance manual for the system that has been installed. These manuals shall be used during the final acceptance testing of the system. Each manual shall contain the following information:
 - 1. As-built drawings
 - 2. Operations and maintenance manuals
 - 3. Single line diagrams showing levels throughout system and impedances

ACCEPTANCE TESTING

- A. The Acceptance Testing shall be performed by the Owner or the Owner's agent. Coordinate this period so that free access, work lighting, and electrical power is available on the site.
- B. Be prepared to verify the performance of any portion of the ICS system by demonstration, listening and viewing tests, and instrumented measurements.
- C. Make additional mechanical and electrical adjustments within the scope of work and which are deemed necessary by the Owner as a result of the acceptance test.

See also Specification Section 17900: Tests, Commissioning and Project Closeout

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

Part 1 – General

1.01 Additional Information

A. Refer to Section 17000 for the following Part 1 General information

- 1) References
- 2) Definitions / Terms / Acronyms
- 3) Submittal Requirements
- 4) Contractor Qualifications
- 5) Manufacturer Qualifications
- 6) Bidder Qualifications
- 7) Testing Agency Qualifications
- 8) Delivery, Storage and Protection
- 9) Project conditions
- 10) Sequencing
- 11) Continuity of Service and Scheduling of Work
- 12) Protection of Work and Property
- 13) Warranty

1.02 Products Installed but not Supplied Under This Section

- A. All conduit and EMT required for Communications cabling pathway in/out of cross connect closets and in/out of wall cavities at the work area. EMT or Conduit for pathways shall have no more than two 90 degree bends and no continuous section over 100'.
- B. All core holes and poke through devices in the floor for the installation of Communications cabling.
- C. All core holes and EMT sleeves between floors for the routing of Communications cabling.
- D. Basket tray or ladder racking to support main pathway cable bundles.

1.03 Backbone Cabling Description

- A. Backbone cabling system will provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- B. Backbone cabling cross-connects may be located in telecommunication rooms or at the entrance facilities.

1.04 Work Included

- A. The Work of this Section shall consist of the labor, materials and equipment required for furnishing and installing backbone cabling as part of a complete and operating telecommunications cabling system.

- B. All items specified or included in this section shall be furnished and installed by Telecommunications Contractor, wired and connected by Telecommunications Contractor and tested by Telecommunications Contractor, unless noted otherwise. "Contractor" as used herein shall mean Telecommunications Contractor or Telecommunications Contractor's sub-contractor.
- C. All items specified or included in this section shall be furnished and installed by Electrical Contractor, wired and connected by Electrical Contractor and tested by Electrical Contractor, unless noted otherwise. "Contractor" as used herein shall mean Electrical Contractor or Electrical Contractor's sub-contractor.

1.05 Submittals

- A. Submit for approval in accordance with specified submittal procedures:

1.06 Coordination

- A. Contractor shall furnish and install the following:
 - 1) Inside plant copper backbone cables.
 - 2) Inside plant fiber optic backbone cables.
- B. Electrical Contractor shall furnish and install the following:
 - 1) Telecommunications raceways within the building as indicated and/or as required by the electrician's sub-contractor for a complete and operational system.

Part 2 – Products

2.01 Multi-Pair Cables

- A. Multi-pair Cable Specification - Inside Plant, Category 3 25 pair
 - 1) Acceptable Manufacturer: Berk-Tek.
 - 2) Cable type: Category 3 CMR.
 - 3) Jacket Material: Fire retardant PVC
 - 4) Jacket Markings: Manufacturer's identification, pair count, wire AWG, sequential footage.
 - 5) Conductors: Solid 24 AWG copper
 - 6) Twisted pairs with varying lay lengths, quantity of pairs as indicated on Drawings.
 - 7) Conductor Insulation:
 - a. CMR – Polyolefin or PVC.
 - 8) Industry standard color coding, with colored binder tape for cables greater than 25-pair.
 - 9) Jacket Color: Varies per application. See schedule on IC001.
 - 10) Electrical Characteristics: Meets TIA/EIA-568B requirements for Category 6 rated cables.

11) CMR rated cable suitable for installation in vertical risers and conduit.

2.02 Fiber Optic Cables

- A. Acceptable Manufacturer: Berk-Tek.
- B. Cable may be either of composite cable construction or standard cable containing single-mode fibers in one cable sheath and multi-mode fibers in a separate cable sheath. Contractor shall verify raceway fill requirements when furnishing and installing two standard cable constructions to meet composite strand count requirements.
- C. Fiber Cable Specification – Contractor shall provide 12 strand OM3 Single-Mode Fiber with SC Connectors, fiber distribution enclosures, termination panels and jumpers as required.
- D. Fiber Optic Cable Shipping Requirements
 - 1) All cabled optical fibers > 1000 meters in length shall be 100% attenuation tested. The attenuation of each fiber shall be provided with each cable reel.
 - 2) Top and bottom ends of the cable shall be available for testing on the shipping reel.
 - 3) Both ends of the cable shall be sealed to prevent the ingress of moisture.
 - 4) Each reel shall have a weather resistant reel tag attached identifying the reel and cable. The reel tag shall include the following information:
 - a. Cable Number, Gross Weight
 - b. Shipped Cable Length in Meters, Job Order Number
 - c. Manufacturer Product Number, Customer Order Number
 - d. Date Cable was Tested, Manufacturer Order Number
 - e. Cable Length Markings, Item Number
 - i Top (inside end of cable)
 - ii Bottom (outside end of cable)
 - 5) Each cable shall be accompanied by a cable data sheet. The cable data sheet shall include the following information:
 - a. Manufacturer Cable Number, Manufacturer Product Number
 - b. Manufacturer Factory Order Number, Customer Name
 - c. Customer Purchase Order Number
 - d. Mark for Information Ordered Length
 - e. Maximum Billable Length, Actual Shipped Length
 - f. Measured Attenuation of Each Fiber Bandwidth Specification (for lengths > 1000 m)
- E. The cable manufacturer shall provide installation procedures and technical support concerning the items contained in this specification.

Part 3 – Execution

3.01 Installation

- A. General
 - 1) All cable and associated hardware shall be placed so as to make efficient use of available space in coordination with other uses. All cable and associated hardware shall be placed so as to not impair the use or capacity of other building systems, equipment, or hardware placed by others (or existing).

- 2) Where cable is placed in ceiling areas or other non-exposed areas, cables shall be installed in cable trays or in non-continuous cable support system. Non-continuous cable supports shall be placed at random intervals no greater than 60 inches. Cables in non-continuous support systems shall be bundled using hook and loop type fasteners. Cable sag between supports shall not exceed 3 inches. Attaching wire to pipes or other mechanical items is not permitted. Cables shall not be bundled or tied in conduits, and in cable trays above ceilings.
- 3) All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, network equipment, mechanical equipment access doors and covers, switches or electrical panels, and lighting fixtures. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser at a later time by maintaining a working distance from these openings. All cable shall be installed to allow for simple installation and removal of cables in the future.
- 4) Unless noted, all interior wiring shall be installed in raceways, Raceway Specification No. 2, one inch minimum. Wiring above accessible ceilings may be installed in cable tray and exposed on "J" hooks.
- 5) All cables not in raceways shall be riser or plenum rated.
- 6) All cables running outside the building shall be rated for outside plant installation.
- 7) Backbone cables shall be grouped separately from horizontal distribution cables. Cable for other systems shall be grouped separately from cables for telephone and data.
- 8) All inside cable shall be installed neatly above accessible ceilings using cable tray and "J" hooks supported from building structure. Do not attach to pipes, conduits, ducts, etc. Do not allow cable to rest on pipes, conduits, ducts, ceiling tiles, etc. Do not attach to wires used for supporting suspended ceilings. Do not use tie wires or bridle rings.
- 9) All wires shall be marked at all junction boxes, pull boxes, cabinets, boxes and terminations. Each cable run between terminating locations shall be one continuous cable (no splices or connections).
- 10) The Contractor shall install cable in such a manner as to prevent stretching, kinking or sharp bends. Cable damaged during installation or not passing required testing shall be removed and replaced at no additional cost to Owner.
- 11) The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over tightened bindings, loosely twisted and over twisted pairs at terminations, and too much jacket removed.
- 12) Minimum bend radius and maximum pulling tension for all cables shall be maintained during and after installation. Install cable in accordance with manufacturer's ratings and instructions.
- 13) Cables shall not be installed near power sources or other items where interference could develop. Cables shall not be placed within 18 inches of light fixtures and within 3 feet of motors, transformers, copy machines, or solid state motor starters unless cable is installed in conduit. Contractor shall furnish and install a grounding conduit system where these minimum clearances cannot be maintained.
- 14) In telecommunications spaces, cables shall be routed as close as possible to the ceiling, floor, or corners to insure that adequate wall or backboard space is available for

current and future equipment and for cable terminations. Cables shall not be tie-wrapped to existing electrical conduit or other equipment. Minimum bend radius shall be observed.

- 15) Dress and attach cables to the backboard along the shortest possible route run square (horizontal and vertical) to the backboard. Bundle similarly routed cables together and attach by means of clamps or distribution rings. Cable dress and attachment shall minimize obstruction to future installations of equipment, backboard, or other cables.
- 16) Cables shall be neatly bundled with hook and loop type fasteners. Nylon tire wraps are not acceptable. Cables must be neatly bundled in the telecommunications spaces and at the cable service loop.
- 17) Cable service loops shall be provided at both ends of backbone cable runs.
 - a. At the telecommunications room, provide a minimum 6 foot service loop stored in the cable tray above the racks/cabinets.
 - b. At the telecommunications room, provide sufficient slack to properly dress and terminate cables at the racks and cabinets.
 - i Provide sufficient slack so that swing gate type racks and cabinets can open fully
 - ii Provide sufficient slack so that cables do not catch or bind at swing gate type rack or cabinet hinge and the cables do not pull taught across the hinge or edge.
 - c. A minimum 25 foot service loop shall be maintained at each building entrance and exit.
- 18) All interior fiber optic cables shall be installed in riser rated innerduct above accessible ceilings.
 - a. Innerduct shall be installed to within 12 inches of termination enclosure.
 - b. Install pull boxes, 12" x 12" minimum, as required to limit cable pulls to two 90 degree bends or 150 feet.
 - c. Innerduct shall not be kinked or tightly bent in any way.
- 19) All exterior fiber optic cables shall be installed in innerduct.
- 20) A break-away link shall be used for installation of cables with a cable-puller or winch. The break-away link shall be designed to separate at or below the recommended maximum tension of the cable being installed.
- 21) Any damage to Owner's existing cabling or existing cable owned by others, caused as a result of work performed under this scope, shall be brought to the Owner's attention and repaired or replaced within 48 hours.
- 22) Contractor shall use only cable lubricants recommended by the manufacturer for use with the specific cable construction.
- 23) Should a cable become kinked, skinned or stretched during installation, the cable shall be removed and replaced at no additional cost to the Owner. Splicing at points other than those specified will not be acceptable.

3.02 Copper Cable Testing

A. Unshielded Twisted Pair Testing Equipment:

- 1) Cable tester will be NRTL certified for EIA/TIA TSB95.

- 2) The cable tester will have a wide variety of preprogrammed cable types as an integral part of its testing system and have the ability to test cables less than 6 feet (6ft.) from the test point.
- 3) All balanced twisted-pair field testers will be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate will be provided for review prior to the start of testing.
- 4) Testing will be accomplished using level III or higher field tester that is loaded with the most current version of test software by the manufacturer of the test equipment.
- 5) Provide factory calibration report of field test equipment.

B. Testing Procedures:

- 1) Test each pair and shield of each cable for opens, shorts, grounds, and pair reversal. Correct grounded and reversed pairs. Examine open and shorted pairs to determine if problem is caused by improper termination. If termination is proper, tag bad pairs at both ends and note on termination sheets.
- 2) Test each UTP cable and passive components. Provide certification that entire installation of UTP cabling, equipment and jacks are NRTL certified meeting or exceeding a minimum of category performance specified on all four pairs of conductors.
- 3) Tests will be based on each pair of conductors and not the aggregate multiple pair results.
- 4) Test all installed cable segments end-to-end, from each telecommunications room backbone patch panel/cross-connect block panel to respective main cross connect, with a Signal Injector, Graphical Link Testing Meter and Time Domain Reflectometer (TDR) for compliance to latest TIA/EIA performance requirements, as well as NEXT, ELFEXT, structural return loss, alternating power sum, opens, shorts, continuity, cable length, and characteristic impedance.
- 5) Provide report indicating failures and what actions were taken to ensure a passing horizontal cable and its terminations. Any cable failing the certification test (Fail, Fail* or, Pass*) must have remedial work done to provide a full pass test result; Remediation may include retermination or replacement of the cable, which fails. No cables passing within tolerance only (Conditional Pass*) will be accepted.

C. Test results:

- 1) The test results information for each link will be recorded in the memory of the field tester upon completion of the test. The tester will be capable of storing test data in either internal or external memory. The external media used will be left to the discretion of the user.
- 2) Test results saved by the tester will be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.

- 3) Optional formats of data reporting are: comma separated variable (.csv), Portable Document File (.pdf) or compatible, plain text (.txt), or hypertext markup language (.html/.htm).
- 4) Test Results will include the following:
 - a. Applicable room number of jack location (room number per Contract Documents)
 - b. Applicable Telecommunications Room number
 - c. Circuit I.D. number with corresponding jack identifier
 - d. Wire Map – will include the following:
 - i Continuity to the remote end
 - ii Shorts between any two or more conductors
 - iii Crossed pairs
 - iv Reversed pairs
 - v Split pairs
 - vi Any other miswiring
 - e. Length
 - f. Insertion Loss
 - g. Near-end Crosstalk (NEXT) Loss
 - h. PS-NEXT (Power Sum Near End Cross Talk)
 - i. ELFEXT (Equal Level Far End Cross Talk)
 - j. PS-ELFEXT (Power Sum Equal Level Far End Cross Talk)
 - k. Propagation Delay
 - l. Delay Skew
 - m. Return loss
- 5) The Owner and Engineer reserve the right to observe testing and/or randomly sample completed links for conformance to project specifications.

3.03 Fiber Optic Cable Testing

A. Fiber Optic Cable Test Equipment:

- 1) Cable tester will be NRTL certified for TIA/EIA TSB95.
- 2) Cable testers will be Optical Power Meter and High Resolution Optical Time Domain Reflectometer (OTDR). The cable tester will be NRTL certified for compliance to latest TIA/EIA Standard 568B performance requirements at 850, 1300 and 1550 nm.
- 3) Testers will have been calibrated at least one year prior to use on this project. Contractor to provide proof to Owner if requested.
- 4) All testing equipment (OTDR, Light Loss, Splicer etc.) will be owned by the Contractor. Contractor must prove ownership of equipment if requested.

B. Cable segments and links will be tested from both ends of the cable for each of the construction phases. (Verify that cable labeling matches at both ends).

C. The system will not be considered certified until the tester has acknowledged that the performance of the physical layer of the system has been fully tested and is operational at the completion of the installation phase.

D. Testing Procedures:

- 1) Perform each visual and mechanical inspection and electrical test, including optional procedures, stated in NETA ATS, Section 7.25. Certify compliance with test

parameters and manufacturer's written recommendations. Test optical performance with optical power meter capable of generating light at all appropriate wavelengths.

- 2) Prior to testing, all connectors will be properly cleaned with an approved product manufactured specifically for this purpose.
- 3) Prior to beginning testing, confirm that all testing equipment is fully charged or operating on building power. If the test equipment power levels drop below 50%, recharge unit or continue testing with a different (fully charged) tester.
- 4) Initially test optical cable with a light source and power meter utilizing procedures as stated in TIA TSB-140, ANSI/TIA/EIA-526-7, ANSI/TIA/EIA-526-14A, OFSTP-14A Optical Power Loss Measurements of Installed Multi-mode Fiber Cable Plant and ANSI/TIA/EIA-526-7 Measurement of Optical Power Loss in installed Single-Mode Fiber cable plant.
- 5) Measured results will be plus/minus 1 dB of submitted loss budget calculations. If loss figures are outside this range, test cable with Optical Time Domain Reflectometer (OTDR) to determine cause of variation. Correct improper splices and replace damaged cables at no charge to the Owner.

E. Multi-Mode Fiber Optic Cables (Not Used)

F. All cables will be tested after termination using a cable certification tester that contains the test equipment manufacturer's most current version of firmware.

G. Test all fiber optic cable segments end-to-end from the fiber optic backbone patch panel in the Equipment Room to each fiber optic backbone patch panel in each Telecommunications Room.

H. Broken or faulty strands will not be accepted. Any cable not fully functional with all strands usable will be replaced at no cost to the Owner.

I. Upon completion of testing, all connectors will be capped with a product made for that specific function by the connecting hardware manufacturer to prevent the contamination of the fiber from construction debris or other foreign objects.

J. Test Results:

- 1) The test results information for each link will be recorded in the memory of the field tester upon completion of the test. The tester will be capable of storing test data in either internal or external memory. The external media used will be left to the discretion of the user.
- 2) Test results saved by the tester will be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.
- 3) The test results information for each link will be recorded in the memory of the field tester upon completion of the test. The tester will be capable of storing test data in either internal or external memory. The external media used will be left to the discretion of the user.
- 4) Test results saved by the tester will be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A

guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.

- 5) Optional formats of data reporting are: comma separated variable (.csv), Portable Document File (.pdf) or compatible, plain text (.txt), or hypertext markup language (.html/.htm).
 - 6) Test results will include the following:
 - a. Telecommunications Room number
 - b. Location of fiber pull i.e. (Equipment Room # to Telecom Room #)
 - c. Patch panel # and location
 - d. Connector type
 - e. Distance
 - f. Wavelength tested
 - g. Technician who performed the testing
- K. The Owner and Engineer reserve the right to observe testing and/or randomly sample completed links for conformance to project specifications.

End of Section

SECURITY SYSTEM

Furnish and install all labor, materials and programming to provide complete and operational building security system.

The Scope of Work shall include:

- a. Access Control Contractor shall use intrusion software compatible with GE Networx systems currently being utilized by the school system. Verify with owner prior to bid.
- b. Access Control Contractor shall include (1) range testing device for each type of wireless security device, if wireless devices are provided, and verify all devices are within operational range of their controlling device. Make provision for supplying additional controllers as required to provide a fully operational system.
- c. Provide dual technology sensors with passive infrared motion and microwave sensing where indicated on the drawings, all corridors, connectors, and dining areas
- d. Receive coded signal from Fire Alarm panel (excluding "trouble status").
- e. Provide coded signal from Fire Alarm panel (excluding "trouble status") to indicate alarm status on GFAA.
- f. Communicator programmed to contact Owner's specified monitoring service.
- g. Vandal-proof controller enclosure.
- h. Security Cameras shall be Panasonic to match existing cameras. Equals as approved by owner and engineer.
 - a. Exterior – 360 Fixed Dome HDTV 1080 with HDMI (WV-S455OL)
 - b. Interior/Hallway – Multi-Direction Selectable HDTV (WV-X4170)
 - c. Vandal Resistant Dome – (WV-S2531LN)
 - d. Compact Dome – (WV-S3531L)
 - e. Pendant Kit (Where Necessary)
 - f. Wall Mount Bracket (Where Necessary)
 - g. Corner Mount Bracket (Where Necessary)
- i. Provide Video Insight recorders with 24 Terra-Byte (TB) storage and software as necessary to accommodate the quantity of inputs required on the job. Include all mounting hardware and software. Also include analog to digital encoders as necessary to accommodate the existing cameras that are to remain.

The Access Control Scope of Work shall include:

- a. All accessories, equipment, programming and installation needed for a door access control system capable of controlling the specific doors as indicated on the electrical/security/IC plans and in the architect's door hardware schedule.
- b. Multi-Class HID Readers, SE RP10 or equal. Black in color.
- c. Single multi-conductor plenum rated cable from Nodes to doors.
- d. Door Access Cable shall be Cat 6, Plenum rated and match existing in color.

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- e. All associated door contacts and request to exit switches. Wired normally closed.
- f. A "Lock-Down" door over-ride push/pull mushroom button. Pull to activate.

Provide the following in necessary quantities to meet the requirements of the plans and schedules or a more current version of the listed equipment:

1.S2 Netbox	S2-NN-E2R-WM
2.HID Reader	S2-900PTNNEK00460-S2EC
3.Door Recessed Switch	GRI 195-12WG-W
4.Armored Door Cords	Enforcer SD-969-S18Q
5.Lock Conversion Kit	Von Duprin QEL 958003-00
6.Reg to Exit Switch	Von Duprin 0502521
7.Key Lock Power Supply	Schlage PS906-KL
8.Battery Back-Up Board	Schlage 900-BB
9.Relay Board	Schlage 900-4R

Access Control and Security System shall be installed by a S2 factory-authorized service organization with minimum five years of successful public school installation experience and licensed in N.C.

Access Control System and associated components shall be by S2 to match school system equipment or as listed above.

END OF SECTION

INTERCOM SYSTEM

Furnish and install all labor, materials and programming to provide complete and operational building Intercom system that is tied back to the existing system.

The Scope of Work shall include:

- a. Intercom Contractor shall provide power supplies, amps, and speaker equipment matching equipment currently being utilized at the school. Verify with owner prior to bid.
- b. Intercom Contractor shall provide, install, program and test any required equipment necessary to expand the existing system to accommodate the new intercom devices in the building addition. See plans.
- c. Provide wire guard protection on any devices located in areas subject to damage. Including but not limited to Gyms, Multi-Purpose Rooms, Weight Rooms, Vocational Education Shops, etc.

Intercom system shall be installed by a factory-authorized service organization with minimum five years of successful installation experience and licensed in N.C.

Intercom System and associated components shall be Bogen to match existing school system equipment or as listed above.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

ACCEPTANCE CRITERIA:

The Owner will verify that all required activities have been performed in a final joint walk-through with the Contractor prior to system acceptance.

There shall be no provisions for automatic acceptance. A phased acceptance test maybe performed; however, acceptance of any phase is conditional on the acceptance of the project as a whole. Full payment will only be made after full and complete acceptance of the entire system. Acceptance shall only occur based on the written notification to the Contractor from the Owner. The following criteria must be met:

1. All cables have been tested and shown as meeting all specifications to the satisfaction of the Owner. All test reports required shall have been submitted and approved by the Owner assigned project manager.
2. All outlets are completely installed and operational in the specified locations.
3. All required patch panels are installed and operational.
4. All patch cables, cross connects, and extension cables have been delivered.
5. Final as-built documentation has been provided by the contractor.
6. Training and tools have been provided to the Owner cable management personnel in the maintenance and use of the installed cabling systems.
7. Each fiber has been tested end-to-end and a written report of signal loss and continuity has been provided.
8. All fire-stops have been installed.
9. The site is clean and neat, ready for permanent use by the Owner.

After the interior wiring system is completed and at such time as the Engineer or Owner's representative may direct, the Contractor shall conduct an operating test for approval. The tests shall be performed in the presence of the authorized representative of the Engineer and the installation shall be demonstrated to operate in accordance with the requirements of this specification. The Contractor shall furnish all instruments and personnel required for the test. The Contractor shall have sufficient tools and personnel available at the scheduled inspection to remove panel fronts, device plates, etc., as required for proper inspection of equipment, devices and wiring installation as may be required by the inspectors. Any material or workmanship which does not meet with approval of the engineer shall be promptly removed, repaired or replaced as directed, at no additional cost to the Owner.

CLEANING AND PAINTING:

Prior to final inspection, all equipment having factory finishes shall be thoroughly cleaned inside and outside. All damaged surfaces shall be replaced or refinished by Contractor, with paint same as original manufacturer. Engineer shall determine whether the damaged surface is to be replaced or painted.

RECORD DRAWINGS AND DOCUMENTATION PACKAGE:

1. Record Drawings
 - a. The Contractor shall maintain accurate records of all deviations in work as actually installed from work indicated on the drawings. On completion of the project, two (2) complete sets of marked-up prints shall be delivered to the Architect.
2. Documentation package
 - a. The successful bidder shall provide one (1) system documentation package on CD and one (1) system documentation paper copy for the installed integrated system. The documentation package shall provide the owner with a comprehensive guide for all operation and maintenance procedures for the "as installed" system. A system block diagram shall indicate the functional relationship between all sub-systems and all elements within individual sub-systems. A cabling schematic shall indicate interconnect wiring with respective numbering or other identification codes and termination block assignment. If requested, schematic drawings shall be provided for each active and passive circuit used in the completed system. All schematic drawings shall indicate the electrical value of each component and its circuit by use of standard electronic symbols.

TRAINING:

A. ICS System

1. Training shall include a minimum of 16 hours of user training for the end user. Training shall be provided at the school or owner designated location in a classroom setting. Training shall be divided into two (2) groups, system administrator and teacher. Training shall also include a video and/or audio format on CD-Rom and shall be formatted for use on individual CD-Rom.

B. Telephone

1. Training shall include a minimum of 8 hours of user training for the end user. Training shall be provided at the school or owner designated location in a classroom setting.

OPERATING AND MAINTENANCE INSTRUCTIONS:

Unless directed otherwise elsewhere in these specifications, the Contractor shall compile and bind two sets of all manufacturer's instructions and descriptive literature on all items of equipment furnished under this work. These instructions shall be delivered to the Engineer for approval prior to final inspection. Instructions shall include operating and testing procedures and a parts list of all equipment. The Contractor shall instruct the Owner's personnel in the proper operation of all systems and equipment. The front of the binder shall be titled "Technology Systems Operating and Maintenance Instructions", with name of the job and firm name of the Contractor.

WARRANTY:

The Contractor shall submit upon completion of the work, a warranty by his acceptance of the contract that all work installed will be free from defects in workmanship and materials. If, during the period of one year, or as otherwise specified from date of Certificate of Completion and acceptance of work, any such defects in workmanship, materials, or performance appear, the Contractor shall, without cost to the

Owner, remedy such defects within reasonable time to be specified in notice from the Architect. In default, the Owner may have such work done and charge cost to Contractor.

END OF SECTION
END OF SPECIFICATIONS