

CONSTRUCTION DOCUMENT
April 28, 2017

**GS #101-297
TECHNOLOGY CLASSROOM BUILDING
ALCORN STATE UNIVERSITY**

Owner:
Bureau of Building, Grounds and
Real Property Management
501 North West Street, Suite 1401B
Jackson, Mississippi 39201

AAG Job No. 2014-04

BID DATE: June 1, 2017
2:00pm, local time



Architect
Allred Architectural Group, PA
628 Washington Avenue-Suite C
Ocean Springs, MS 39564
Tel: 228-762-1975

Civil and Structural Engineer
Simpkins & Costelli, Inc.
401 32nd 1/2 Street
Gulfport, MS 39507
Tel: 228-864-6289

Mechanical Engineer
Edmonds Engineering, Inc.
1855 Lakeland Drive
Jackson, MS 39216
Tel: 601-362-6478

Electrical Engineer
Schultz & Wynne, PA
4523 Office Park Drive
Jackson, MS 39206
Tel: 601-982-3313

Commissioning
Sanders Engineering, Inc.
604 Highway 80 West, Suite J
Clinton, MS 39056
Tel: 601-924-0047

SET NO. _____

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**DEPARTMENT OF FINANCE AND ADMINISTRATION
BUREAU OF BUILDING, GROUNDS AND
REAL PROPERTY MANAGEMENT
JACKSON, MISSISSIPPI**

ADVERTISEMENT FOR BIDS

Sealed bids will be received at the Bureau of Building, Grounds and Real Property Management, 501 North West Street, Suite 1401 B, Jackson, Mississippi, 39201, until 2:00:00 p.m. on Thursday, 06/01/2017 , for:

RE: GS# 101-297 Technology Classroom Building
Alcorn State University

at which time they will be publicly opened and read. Contract documents may be obtained from:

Professional: Allred Architectural Group, PA
Address: 628 Washington Avenue, Suite C
Ocean Springs, Mississippi 39564
Phone: 228-762-1975
Email: chet@allredarchitecturalgroup.com

A deposit of \$350.00 is required. Bid preparation will be in accordance with Instructions to Bidders bound in the project manual. The Bureau of Building, Grounds and Real Property Management reserves the right to waive irregularities and to reject any or all bids. **NOTE: Telephones and desks will not be available for bidders use at the bid site.**

Glenn R. Kornbrek, Bureau Director
Bureau of Building, Grounds and Real Property Management

Dates of Publication:

05/02/2017

05/09/2017

INSTRUCTIONS TO BIDDERS

SECTION 00100

PART 1 - GENERAL

- 1.01 **QUESTIONS:** Questions should be directed to the Professional. Should a Bidder find discrepancies in, or omissions from, the Drawings or Project Manual, or be in doubt as to their meaning, the Bidder should immediately notify the Professional. The Professional will send written instruction(s) or interpretation(s) to all known holders of the documents. Neither the Owner, nor the Professional, will be responsible for any oral instruction or interpretation.
- 1.02 **BIDDER'S QUALIFICATIONS:**
- A. **Certificate of Responsibility:** The Mississippi State Board of Contractors is responsible for issuing Certificates of Responsibility to Contractors. To be awarded a Contract for public work, Sections 31-3-15 and 31-3-21 of the **Mississippi Code 1972, Annotated** requires a Contractor to have a current Certificate of Responsibility at bid time and during the entire length of the job. The Certificate of Responsibility number issued becomes a significant item in all public bidding.
 - B. **Bid Under \$50,000:** If a Bidder submits a bid not exceeding \$50,000, no Certificate of Responsibility number is required; however, a notation stating the *bid does not exceed \$50,000* must appear on the face of the envelope, or a Certificate of Responsibility number.
 - C. **Bid Over \$50,000:** Each Bidder submitting a bid in excess of \$50,000 must show its Certificate of Responsibility number on the bid and on the face of the envelope containing the bid.
 - D. **Joint Venture Bid:** When multiple Contractors submit a joint venture bid in excess of \$50,000, a *joint venture* Certificate of Responsibility number must be shown on the bid and on the face of the envelope containing the bid. If the Multiple-Contractor joint venture has no *joint venture* Certificate of Responsibility number, each of the Contractors participating in the bid must indicate their individual Certificate of Responsibility numbers on the bid and on the face of the envelope.
- 1.03 **NON-RESIDENT BIDDER:** When a non-resident Bidder (a Contractor whose principal place of business is outside the State of Mississippi) submits a bid for a Mississippi public works project, one of the following is required and shall be submitted with the Proposal Form:
- A. **Copy of Law:** If the non-resident Bidder's state has a resident Bidder preference law, a copy of that CURRENT law shall be submitted with the Proposal Form. (modified to "current" August 2016)
 - B. **Statement:** If the state has no such law then a statement indicating *the State of (Name of State) has no resident Contractor preference law* shall be submitted with the Proposal Form.
- 1.04 **DISQUALIFICATION OF BIDDER:** A Bidder may be disqualified for any of the following reasons: (see 600.53) (modified Sept-Nov 2016)
- A. Failure to comply with the bid requirements.
 - B. Bidder is in arrears on existing Contracts with the Bureau or another state agency, university, community college, or junior college.
 - C. Bidder is involved in an ongoing dispute related to the Bidder's execution, workmanship, or timely performance of a previous Contract with the Bureau or another state agency, university, community college, or junior college.
 - D. Bidder has defaulted on a previous Contract with the Bureau of another state agency, university, community college, or junior college.
- 1.05 **CONDITIONS OF WORK:** Each Bidder must fully inform himself of all conditions relating to the construction of the Project and employment of labor thereon. Failure to do so will not relieve a successful Bidder of obligations to furnish all material and labor necessary to carry out the provisions of the Contract. Insofar as possible, the Bidder must employ methods, or means, which will not cause interruption of, or interference with, the work of any other Bidder, or Contractor.
- 1.06 **EXAMINATION OF SITE:** All Bidders, including the general Contractor and Subcontractors, shall visit the building site, compare the Drawings and Project Manual with any work in place and be informed of all conditions. Failure to visit the site will in no way relieve the successful Bidder from furnishing any materials or performing any work required to complete work in accordance with Drawings and Project Manual without additional cost to the Owner.
- 1.07 **LAWS AND REGULATIONS:** The Bidder's attention is directed to the fact that all applicable Mississippi state laws, rules and regulations of all authorities having jurisdiction over construction of the Project apply to the Contract.

- 1.08 **OBLIGATION OF BIDDER:** At the bid opening, each Bidder will be presumed to have inspected the site, read and become thoroughly familiar with the Drawings and the Project Manual, including all addenda.
- 1.09 **BID DOCUMENT DEPOSIT AND RETURN:** The deposit amount, if any, shall be established as the estimated actual cost of copying and reproduction plus shipping via USPS standard Ground Transportation, is shall be indicated in the Advertisement for Bids. Bidders may request shipping via express carrier or expedited delivery at their own additional cost. Upon returning the documents to the Professional within ten (10) working days of the bid date and in good condition, all document holders will be refunded the full deposit amount. Further, any document holder who is awarded the contract, related subcontracts and/or vendor agreements may elect to retain their documents and request refund of the full deposit amount upon execution of the construction contract and approval of general contractor, however; such documents shall be counted toward the total number of copies furnished free of charge to the general contractor. No partial sets of documents will be issued. Selected trade organizations, plan rooms and web-based distribution networks will be issued one (1) set of documents without charge. (modified August 2016) (see 600.50)

PART 2 - PROPOSAL FORM

- 2.01 **METHOD OF BIDDING:** Lump sum, single bids received on a general contract will include general, mechanical and electrical construction and all work shown on Drawings or specified in the Project Manual.
- 2.02 **PROPOSAL FORMS:** The Bidder shall make all proposals on forms provided and shall fill all applicable blank spaces without interlineations or alteration and must not contain recapitulation of the work to be done. No oral or telegraphic proposals will be considered.
- 2.03 **TIME OF COMPLETION:** The Bidder shall agree to commence work on, or before, a date specified in a written *Notice to Proceed* and fully complete the Project within the calendar days indicated on the Proposal Form.
- 2.04 **BASE BID AND ALTERNATES:**
- A. On the Proposal Form, the Bidder shall write out the Base Bid amount in words and include the numerical amount. The written word shall govern.
 - B. The Proposal Form shall contain a brief description of each alternate modifying the scope. The Bidder shall write out the amount in words and include the numerical amount for each alternate. The written word shall govern. Refer to Section 01030 entitled *Alternates* for additional information.
- 2.05 **SUBSTITUTIONS:** No substitutions, qualifications or redefining of the Specification requirements are allowed to be marked on the Proposal Form, unless specifically required by the Bid Documents. Refer to Section 01630 entitled *Substitutions and Product Options* which covers procedures after the award of Contract (see 600.25.) (2.05 unchanged but modified 01630 August 2016)
- 2.06 **ADDENDA:** Any addenda to the Drawings or Project Manual issued before or during the time of bidding shall be included in the proposal and become a part of the Contract. The Proposal Form will have ample space to indicate the receipt of addenda. When completing the Proposal Form, the Bidder shall list the Addendum number in spaces provided. (see proposal form) (modified August 2016)
- 2.07 **BIDDER IDENTIFICATION:**
- A. **Signature:** The Proposal Form shall be signed by any individual authorized to enter into a binding agreement for the Business making the bid proposal.
 - B. **Name of Business:** The name appearing on the Proposal Form should be the complete spelling of bidder's name - exact as recorded at the Secretary of State [<http://www.sos.state.ms.us/busserv/corp/soskb/csearch.asp>] which should be the same as you applied for at the Mississippi State Board of Contractors [<http://www.msbc.us/Search2.CFM>] (see 2.07, 3.01, 5.01, proposal form)
 - C. **Legal Address:** The address appearing on the Proposal Form should be the same address exact as recorded at the Secretary of State [<http://www.sos.state.ms.us/busserv/corp/soskb/csearch.asp>] which should be the same as you applied for at the Mississippi State Board of Contractors [<http://www.msbc.us/Search2.CFM>]
 - D. **Certificate of Responsibility Number(s):** The Certificate of Responsibility Number(s) appearing on the Proposal Form should be the same number appearing in the current Mississippi State Board of Contractors Roster.
- 2.08 **BID SECURITY:** The Bid Security shall be in the form of a Bid Bond, or a Certified Check: (modified Dec 2013 SoS) (see also 4.07 herein, 600.42, 600.57.9, 00600, 00650)
- A. **Bid Bond:** The Bidder may submit a Bid Bond by a Surety licensed in Mississippi in the amount of five percent (5%) of the base bid. The Bid Bond shall be duly executed by the Bidder, a Mississippi Licensed Agent for said Surety approved by the Mississippi Insurance Department OR signed by the Surety AND countersigned by a Mississippi Licensed Agent for said Surety approved by the Mississippi Insurance Department. http://www.mid.state.ms.us/licapp/search_main.aspx <https://www.mid.ms.gov> (or most up-to-date link) (No standard form is required for the Bid Bond.)

B. **Certified Check:** The Bidder may submit a certified check made out to the *Bureau of Building, Grounds and Real Property Management* in the amount of five percent (5%) of the base bid. All checks received from Bidders will be returned upon request, unless a Bidder is one (1) of the three (3) apparent low Bidders. The three (3) apparent low Bidder's checks will be held for forty-five (45) days, unless a Contract is awarded and executed in less time.

2.09 **POWER OF ATTORNEY:** Each bid security must be accompanied by an appropriate Power of Attorney. No Power of Attorney is necessary with a certified check.

PART 3 - SUBMITTING THE PROPOSAL FORM

3.01 **SUBMITTAL:** A bid must be delivered to the address indicated on the Advertisement for Bids prior to the time and date stated. Only one original of Bid Proposal shall be submitted which should be sealed in an opaque envelope marked, mailed or hand-delivered as follows: (beginning 1/1/09 and for a reasonable time period, a duplicate copy will not disqualify your bid, but the second copy, without comparison, will be destroyed in the bid opening, not read aloud nor used thereafter, in order to prevent inadvertent differences in the duplicate forms): (also see 600.42)

(In upper left hand corner)

Name of Firm (complete spelling of bidder's name and address – exact as recorded at the Secretary of State which should be the same as you applied for at the Mississippi State Board of Contractors – see 2.07, 3.01, 5.01)

(Bid shall be addressed and delivered to)

Bureau of Building, Grounds and Real Property Management
501 North West Street, Suite 1401B [Woolfolk Building]
Jackson, Mississippi 39201

(In lower left hand corner)

Bid for Project # _____

Title _____

Using Agency _____

Certificate of Responsibility # _____ (for over \$50,000.00)

Under \$50,000.00 (add statement)

If the Bid is mailed, the bid envelope shall be placed inside a second envelope to prevent inadvertent premature opening of the Proposal.

3.02 **MODIFICATION TO BID:** A bidder may modify the bid prior to the scheduled closing time indicated in the Advertisement for Bids in the following manner:

- A. **Notification on Envelope:** A modification may be written on the outside of the sealed envelope containing the bid.
- B. **Facsimile:** A facsimile (fax) will not be acceptable.

3.03 **WITHDRAWAL OF BID:** Any bid may be withdrawn prior to the scheduled time for opening of bids. However, bids may not be withdrawn until forty-five (45) days after bid opening.

PART 4 - BID OPENING AND AWARD OF CONTRACT

4.01 **OPENING OF BIDS:** Bids will be publicly opened shortly after the time stated in the Advertisement for Bids. Bidder representatives are invited; however, attendance is not mandatory.

Closure of agency preventing the opening of bids at the advertised date and time due to Force Majeure Event reasons will result in bids being publicly opened . . . on the next business day that the agency shall be open and at the previously advertised time See 600.47 of the BoB Procedure Manual for wording in detail. (added Jan 2015)

4.02 **IRREGULARITIES:** The omission of any information requested on the Proposal Form may be considered as an informality, or irregularity, by the awarding public body when in their opinion the omitted information does not alter the amounts contained in the submitted bid proposal, or place other Bidders at a disadvantage.

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- 4.03 **PROTEST:** Any protest must be delivered in writing to the Owner within twenty-four (24) hours after the bid opening.
- 4.04 **ERRORS:** Any claim of error and request for release from bid must be delivered in writing to the Owner within twenty-four (24) hours after the bid opening. The Bidder shall provide sufficient documentation with the written request clearly proving an error was made.
- 4.05 **AWARD OF CONTRACT:** The Owner reserves the right to reject any, or all bids. A Contract will be awarded on the basis of the low base bid, or low combination of base bid and those alternates selected by the Owner in any order determined to be in the best interest of the Using Agency and which produces a total within available funds.
- 4.06 **FAILURE TO ENTER INTO A CONTRACT:** The Bidder shall forfeit the Bid Security to the Owner as liquidated damages for failure, or refusal, to execute and deliver the Contract, Bond and Certificate of Insurance within ten (10) working days after notice of the acceptance of the bid/receipt of Contracts from the Professional. (*“working” days added 11/3/10 (modified Jan 2015)*)
- 4.07 **SECURITY FOR FAITHFUL PERFORMANCE:** (modified Dec 2013 SoS; Jan 2015 SoS) (see also 2.08 herein, 600.42, 600.57.9, 00600, 00650)
- Simultaneously, with delivery of the executed Contract, the Contractor will furnish a Surety Bond, or Bonds, as security for faithful performance, the payment of all persons performing labor on the project, and furnishing materials in connection with this Contract. The Surety on such Bond, or Bonds, will be a duly authorized surety company satisfactory to the Owner and meeting all of the following requirements:
- A. Licensed at the time of award by the State of Mississippi's Commissioner of Insurance for the purpose of providing surety. . http://www.mid.state.ms.us/licapp/search_main.aspx <https://www.mid.ms.gov> (or most up-to-date link)
 - B. Listed at the time of award in the Department of the Treasury's **Federal Register** as a company holding certificates of authority as acceptable sureties on Federal Bonds, commonly referred to as the Treasury List.
 - C. All Bonds shall be executed on the form provided in the Project Manual under Section 00600 entitled *Contract Bond*.
 - D. The Contract Bond shall be duly executed by the Bidder, a Surety licensed in Mississippi signed by a Mississippi Licensed Agent for said Surety approved by the Mississippi Insurance Department OR signed by the Surety AND countersigned by a Mississippi Licensed Agent for said Surety approved by the Mississippi Insurance Department with the name and address typed, or lettered legibly. (with Surety Seal, preferably embossed seal). http://www.mid.state.ms.us/licapp/search_main.aspx <https://www.mid.ms.gov> (or most up-to-date link)
 - E. All Bonds must be accompanied by an appropriate Power of Attorney dated same as Contract Bond (with Seal, preferably embossed seal).

PART 5 - BIDDER'S CHECKLIST

The following checklist is for the Bidder's assistance only. It is not inclusive and **is not a part of the bid documents**; therefore, this checklist does not have to be included with the Proposal Form when submitting a bid proposal.

5.01 **PROPOSAL FORM:** (only one original proposal form to be submitted) (also see 3.01 and 600.42 of Manual)
Base Bid

() Write in the amount of the base bid in words and numbers. The written word shall govern.

Alternates

() Write in each alternates amount in words and numbers. The written word shall govern.

Addenda

() Acknowledge the receipt of each addendum by writing in the number of the addendum. (modified August 2016)

Acceptance

() Proposal is signed by authorized person

() Name of Business - complete spelling of bidder's name and address - exact as recorded at the Secretary of State

[<http://www.sos.state.ms.us/busserv/corp/soskb/csearch.asp>] which should be the same as you applied for at the Mississippi State Board of Contractors [<http://www.msbc.us/Search2.CFM>] (see 2.07, 3.01, 5.01, proposal form)

() Legal address of the business listed above (at SOS and Contractor's Board)

() Correct Certificate of Responsibility Number(s) as it appears in the current Mississippi State Board of Contractors Roster

Certificate of Responsibility Number(s) on envelope (see below for on proposal form)

() Base Bid is under \$50,000 and no number is required

() Base Bid is under \$50,000 and the statement "bid does not exceed \$50,000" is on the outside of the sealed envelope

() Base Bid is over \$50,000 and number is required

() Joint Venture and *joint venture* number is required

OR () Joint Venture participants' numbers are required

5.02 **BID SECURITY:**

() Included Bid Bond

OR () Included Certified Check

5.03 **POWER OF ATTORNEY:**

() Included Power of Attorney

5.04 **NON-RESIDENT BIDDER:**

() Attached a Copy of Non-Resident Bidder's Preference Law

OR () Attached a Statement

5.05 **SUB-CONTRACTORS NAME Refer to 1.04 for responsiveness** (modified Dec 2013 SoS per 10/17/12 Addendum 1)

() List ~~you~~ any Mechanical, Plumbing, and/or Electrical Sub-Contractors regardless of cost. * List name even for under \$50,000

* Fire Protection Sprinkler Contractors do not have to be listed

* If there is a separate HVAC/Plumbing Sub-Contractor, so notate as mentioned herein

* If Mechanical, Plumbing, and/or Electrical Sub-Contractor is performed by the General, be sure the General has a COR for said discipline

* If there is no Mechanical, Plumbing, and/or Electrical Sub-Contractor listed, then use of Sub-Contractor to perform such scope will not be permitted.

5.06 **SUB-CONTRACTORS' COR NUMBER Refer to 1.04 for responsiveness** (modified Dec 2013 SoS per 10/17/12 Addendum 1)

() * List Certificate of Responsibility Number for any listed Sub-Contractor over \$50,000.00

* If under \$50,000 – so notate on the COR line “under \$50,000” (or can still show COR#)

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

PROPOSAL FORM
SECTION 00300

To: Bureau of Building, Grounds and Real Property Management
501 North West Street, Suite 1401B [Woolfolk Building]
Jackson, Mississippi 39201

Re: Project # GS#101-297
Project Title Technology Classroom Building
Location Alcorn State University

I propose to complete all work in accordance with the Project Manual and Drawings within 450 consecutive calendar days for the sum of: (Professional must specify number of days)

BASE BID: (Write in the amount of the base bid in words and numbers. The written word shall govern.)

_____ Dollars (\$_____)

ALTERNATES: (Write in the amount of all of the alternates in words and numbers. The written word shall govern.)

Alternate #1 () Adds (X) Deducts

_____ Dollars (\$_____)

Description Deductive Alternate to omit the Amphitheater

Alternate #2 () Adds (X) Deducts

_____ Dollars (\$_____)

Description Deductive Alternate to omit the Fixed Audience Seating and Multiple Seating Systems

Alternate #3 () Adds (X) Deducts

_____ Dollars (\$_____)

Description Deductive Alternate to install Porcelain Tile and Base on the Second and Third floors in lieu of Thin-Set Epoxy Terrazzo Flooring System and Base

Alternate #4 () Adds (X) Deducts

_____ Dollars (\$_____)

Description Deductive Alternate to install the Water Treatment Softener system

Alternate #5 () Adds () Deducts

_____ Dollars (\$_____)

Description _____

ADDENDA ACKNOWLEDGMENT: (modified dates August 2016)

No. _____ No. _____ No. _____
No. _____ No. _____ No. _____

ACCEPTANCE:

I certify that I am authorized to enter into a binding contract, if this Proposal is accepted.

Signature _____ Date _____
Name and Title _____
Name of Business _____

Complete spelling of bidder's name and address - **exact as recorded at the Secretary of State**

[<http://www.sos.state.ms.us/busserv/corp/soskb/csearch.asp>] which should be the same as you applied for at the Mississippi State Board of

Contractors [<http://www.msbc.us/Search2.CFM>] (see 2.07, 3.01, 5.01) **PLEASE LOOK IT UP at SoS. SoS rules when the 2 are different.**

Address _____ (mailing)
Address _____ (physical)
City/State/Zip Code _____ County _____
Phone _____ Fax _____ Email _____

- **Bidder's Certificate of Responsibility Numbers(s):** _____
- **MINORITY BUSINESS ENTERPRISE?** Yes _____ No _____ (to assist with Code 57-1-57)

-
- Attach copy of Non-Resident Bidder's Preference Law (5.04 of Bidder's Checklist)

-
- **Mechanical / Plumbing / Electrical Contractors:** (modified Dec 2013 SoS per 10/17/12 Addendum 1 & Feb 2014)
Regarding said Divisions of the Specifications of the BoB Standard Form of Agreement Between The Owner and The Contractor

List any Mechanical/Plumbing and/or Electrical Sub-Contractors that will perform work of this contract. COR must be included where sub-contract exceeds \$50,000.00. If no sub-contractor is listed, and such work is within scope of contract, bidder's own COR classification(s) must be sufficient to self-perform any such work. If no sub-contractor is listed, then use of sub-contractor to perform such scope will not be permitted. This is in accordance with 5.05 and 5.06 of the Bidder's Checklist revised below.

Mechanical Contractor: _____ Certificate of Responsibility No. _____
Plumbing Contractor: _____ Certificate of Responsibility No. _____
Electrical Contractor: _____ Certificate of Responsibility No. _____

-
- Mississippi Department of Agriculture & Commerce
Bureau of Plant Industry
Landscape License Number _____ MS Code 69-19-1 – 69-19-15
↑Complete for prime landscaping projects
-

**STANDARD FORM OF AGREEMENT BETWEEN
THE OWNER AND THE CONTRACTOR
SECTION 00500**

This Agreement made the _____ day of _____, 20____ between the Owner,

Bureau of Building, Grounds and Real Property Management
501 North West Street, Suite 1401B [Woolfolk Building]
Jackson, Mississippi 39201

created by Section 7-1-451 et seq., and Section 31-11-1, et seq., **Mississippi Code of 1972, Annotated**, and acting for the State of Mississippi;
and between the Contractor:

Business Name _____
Address _____
City/State/Zip _____ Fax: _____ Email: _____

The Contractor is a (check and complete one of the following):

_____ CORPORATION or LLC solely organized and existing under the laws of the State of _____
and having its principal office in _____, _____, _____
(City) (County) (State)

_____ PARTNERSHIP of the following (list all partners):

_____ SOLE PROPRIETORSHIP

For the following Project:

GS# 101-297 Technology Classroom Building
Alcorn State University

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

OWNER: BUREAU OF BUILDING, GROUNDS AND
REAL PROPERTY MANAGEMENT

CONTRACTOR:

By: _____
(Signature)

By: _____
(Signature)

Glenn R. Kornbrek, Director

(Name and Title)

(Name and Title)

APPROVED AS TO FORM:

By: _____
(Signature of Attorney)

THE OWNER AND THE CONTRACTOR AGREE AS SET FORTH IN PAGES ONE THROUGH THREE, ARTICLES ONE THROUGH FIVE, AS FOLLOWS:

ARTICLE 1: THE WORK AND CONTRACT DOCUMENTS
THE WORK

1.1.1 The Contractor will perform all the work required by the Contract Documents for the Project indicated above.

1.2 **THE CONTRACT DOCUMENTS**

1.2.1 The Contract Documents which constitute the entire Agreement between the Owner and the Contractor, are enumerated as follows:

1.2.2 Project Manual dated April 28, 2017

BIDDING REQUIREMENTS

- Advertisement for Bids
- Instructions to Bidders
- Proposal Form

STANDARD FORM OF AGREEMENT BETWEEN THE OWNER AND THE CONTRACTOR

CONTRACT BOND

POWER OF ATTORNEY

CERTIFICATE OF INSURANCE

CONDITIONS OF THE CONTRACT

- General Conditions
- Supplementary Conditions
- Labor Requirements
- Addenda

SPECIFICATIONS (check the specs listed on the contents and included in the manual)

- Division One: General Requirements
- Division One Supplements
- Division Two: Site Work
- Division Three: Concrete
- Division Four: Masonry
- Division Five: Metals
- Division Six: Wood and Plastics
- Division Seven: Thermal and Moisture Protection
- Division Eight: Doors and Windows
- Division Nine: Finishes
- Division Ten: Specialties
- Division Eleven: Equipment
- Division Twelve: Furnishings
- Division Thirteen: Special Construction
- Division Fourteen: Conveying Systems
- Division Fifteen: Mechanical
- Division Sixteen: Electrical
- Division Seventeen: Commissioning

1.2.3 Addenda

- Addendum No. 1, dated _____
- Addendum No. 2, dated _____
- Addendum No. 3, dated _____
- Addendum No. 4, dated _____
- Addendum No. 5, dated _____

1.2.4 Drawings dated April 28, 2017

- | | |
|------------------------------------------------|------------------------------------------------|
| Sheets No. <u>00b</u> through <u>00b</u> | Sheets No. <u>MS1.01</u> through <u>MS1.02</u> |
| Sheets No. <u>G.01</u> through <u>G.05</u> | Sheets No. <u>P1.01</u> through <u>P4.01</u> |
| Sheets No. <u>C.00</u> through <u>C.700</u> | Sheets No. <u>M1.01</u> through <u>M5.03</u> |
| Sheets No. <u>S1.00</u> through <u>S6.11</u> | Sheets No. <u>MP1.01</u> through <u>MP4.01</u> |
| Sheets No. <u>A1.01</u> through <u>A8.05</u> | Sheets No. <u>AV0.1</u> through <u>AV1.7</u> |
| Sheets No. <u>FP1.01</u> through <u>FP4.01</u> | Sheets No. <u>E-0.1</u> through <u>E-6.6</u> |

1.2.5.1 Other documents, dated _____

ARTICLE 2: CONTRACT SUM

2.1 CONTRACT SUM

2.1.1 The Owner will pay the Contractor in current funds for the performance of the work, subject to additions and deductions by Change Order as provided in the Contract Documents, the Contract sum of _____ Dollars

(\$ _____). The Contract sum is determined as follows:

Base Bid		\$ _____
Modifications	() Adds () Deducts	\$ _____
Negotiations		\$ _____
Alternate No. _____	() Adds () Deducts	\$ _____
Alternate No. _____	() Adds () Deducts	\$ _____
Alternate No. _____	() Adds () Deducts	\$ _____
Alternate No. _____	() Adds () Deducts	\$ _____
Alternate No. _____	() Adds () Deducts	\$ _____
Total Contract Sum		\$ _____

2.2 LIQUIDATED DAMAGES

2.2.1 The stipulated liquidated damages described in Paragraph 9.11 of the *Supplementary Conditions* are in the amount of _____ Five Hundred _____ Dollars (\$ 500.00) for each calendar day.

ARTICLE 3: CONTRACT TIME

3.1 TIME

3.1.1 The work to be performed under this Contract shall be commenced upon the date stated in the *Notice to Proceed*. The work is to be substantially complete, subject to approved Change Orders, no later than 450 calendar days from the date stated in the *Notice to Proceed*.

ARTICLE 4: PAYMENTS AND FINAL PAYMENTS

4.1 PROGRESS PAYMENTS

4.1.1 Based upon applications for payment submitted to the Professional by the Contractor and *Certificates for Payment* issued by the Professional, the Owner will make progress payments on account of the Contract sum to the Contractor as provided in the Contract Documents.

4.2 FINAL PAYMENT

4.2.1 Final payment constituting the entire balance of the Contract sum will be paid by the Owner to the Contractor when the work has been completed, the Contract fully performed and a final Certificate for Payment has been issued by the Professional and approved by the Owner.

ARTICLE 5: MISCELLANEOUS PROVISION

5.1 DEFINITION OF TERMS

5.1.1 Terms used in this Agreement which are defined in the Conditions of the Contract will have the meanings designated in those Conditions.

5.2 CONTRACTOR'S INTEREST IN AGREEMENT

5.2.1 The Contractor will not assign, sublet, or transfer the interest in this Contract agreement without the written consent of the Owner. The Owner and Contractor hereby agree to the full performance of the covenants contained herein.

5.3 PROFESSIONAL

5.3.1 The Professional assigned to this Project is as follows:

Name Allred Architectural Group, PA
Address 628 Washington Avenue, Suite C, Ocean Springs, MS 39564
Telephone 228-762-1975 Fax Number N/A E-Mail Address hoppy@allredarchitecturalgroup.com

*** END OF SECTION ***

**CONTRACT BOND
SECTION 00600**

I. PREAMBLE

KNOW ALL MEN BY THESE PRESENTS: THAT _____,
Principal, a _____, residing at _____,
authorized to do business in the State of Mississippi under
the laws thereof, and _____ Surety, a corporation of the State of
_____, authorized to do business in the State of Mississippi under the laws thereof, are held and firmly bound
unto the Bureau of Building, Grounds and Real Property Management of the State of Mississippi, Oblige, hereinafter referred to as "Owner," for the
use and benefit of the Owner and those claimants and others set forth herein below and described in Sections 31-5-51 and 31-5-3, **Mississippi Code
of 1972, Annotated**, as amended, in the amount of _____
Dollars (\$ _____), lawful
money of the United States, for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and
assigns, jointly and severally, firmly by these present.

WHEREAS, Principal has by written agreement dated _____, 20_____, entered into a Contract with the
Owner for the following:

as provided in said Contract and in accordance with the Contract Documents. All of the terms and provisions of the above mentioned Contract,
drawings, Project Manual, and addenda are by reference made a part hereof and fully incorporated herein, and are hereinafter referred to as "the
Contract." All of the terms and provisions of Sections 31-5-51, 31-5-3, supra, Section 31-5-53 of the **Mississippi Code of 1972, Annotated**, as
amended, and all other code sections cited herein are also by reference made a part hereof and fully incorporated herein.

II. PERFORMANCE BOND

NOW, THEREFORE, the condition of this Performance Bond is such that if Principal shall promptly and faithfully perform said Contract, then this
obligation shall be null and void; otherwise, it shall remain in full force and effect, subject however, to the following conditions:

Whenever the Owner has performed its obligation but the Principal has defaulted under the terms of the Contract, or any portion thereof, and the
Owner has declared the Principal to be in default, the Surety shall promptly:

- 1. Remedy the default, or
- 2. Complete the Contract in accordance with its terms and conditions, or
- 3. Procure the completion of the Contract in accordance with its terms and conditions.

Even if there should be a succession of defaults, the Surety is responsible for completion of the Contract. The Surety shall provide sufficient funds to
pay the cost of completion of the Contract in its entirety including other costs and damages for which the Surety may be liable thereunder, less the
balance of the Contract price. The term "balance of the Contract price," as used in this paragraph, shall mean the total amount payable by Owner to
Principal under the Contract and any Change Orders thereto, less the amount paid by Owner to Principal.

III. LABOR AND MATERIAL PAYMENT BOND

NOW, THEREFORE, the condition of this Labor and Material Payment Bond is such that if Principal shall promptly make payments to all persons
supplying labor or material used in the prosecution of the work under said Contract, then this obligation shall be null and void; otherwise, it shall
remain in full force and effect; however, the Owner shall not be liable for the payment of any costs or expenses of any suit described in Subsection (2)
of Section 31-5-51, supra.

IV. BOND FOR PAYMENT OF TAXES AND OTHER ASSESSMENTS

NOW THEREFORE, the condition of this Bond for Payment of Taxes and Other Assessments is such that if Principal shall promptly make payment of all taxes, licenses, assignments, contributions, damages, penalties, and interest thereon, when and as the same may lawfully be due the State of Mississippi, or any County, Municipality, Board, Department, Commission, or political subdivision thereof, by reason of and directly connected with the performance of said Contract or any part thereof as provided by Sections 27-65-1, 27-65-21, 27-67-1, and 31-5-3, **Mississippi Code 1972, Annotated**, or any other applicable statute or other authority, then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

V. GENERAL CONDITIONS

The following conditions apply to all three (3) of the above-mentioned Bonds:

1. The Performance Bond is for an amount equal to the full amount of said Contract.
2. The Labor and Material Payment Bond is for an amount equal to the full amount of said Contract.
3. If any changes are made in the work, or any extensions of time are granted, or any increases in the total dollar amount of the Contract are made, such changes, extensions, increases, or other forbearance on the part of either the Owner or the Principal will not, in any way, release the Principal and Surety, or either of them, from their liability hereunder, or any portion thereof, notice to the Surety of any such change, extension, increase, or forbearance being expressly waived.
4. These Bonds are governed by and shall be construed in accordance with Mississippi law. Any inconsistency with these Bonds and any provision of Mississippi law shall be remedied by deleting the inconsistent portion of these Bonds and leaving the remaining consistent portions in full force and effect.

Signed and sealed this _____ day of _____, 20_____.

SURETY _____
Mississippi NAIC number: _____

By: _____
(Signature)

Attorney-in-Fact
(Typed Name) (Title)

Surety Agent Mississippi License Number: _____

(Surety Address)

(Surety City/State/Zip/Phone)

COUNTERSIGNED: (if applicable)

MISSISSIPPI LICENSED AGENT COMPANY NAME
Mississippi NAIC number: _____

(Signature)

Licensed Mississippi Agent
(Typed Name) (Title)

Countersignature Agent MS License Number: _____

(MS Licensed Agent Address)

(MS Licensed Agent City/State/Zip/Phone)

PRINCIPAL _____

By: _____
(Signature) (same person on Bond and Contract page)

(Typed Name and Title)

(Address)

(City/State/Zip/Phone)

Surety Company, Surety Agent's Name, Address, etc. should be typed and with seal (preferably embossed seal) on Bond and P/A. The P/A should be for the Attorney-in-Fact with seal (preferably embossed seal).

The Contract Bond shall be duly executed by the Bidder AND a MS Licensed Agent said Surety approved by the MS Ins Dept
OR
signed by the Surety's Agent AND countersigned by a MS Licensed Agent for said Surety approved by the MS Ins Dept.

Countersignature can be the same as the Attorney-in-Fact when the Attorney-in-Fact is licensed in Mississippi. Countersignature will be different when the Attorney-in-Fact is "not" licensed in Mississippi. P/A will be for the Attorney-in-Fact.

Check the Surety Company AND the Surety Agent AND/OR the Countersignature at MS Ins Dept web: http://www.mid.state.ms.us/licapp/search_main.aspx <https://www.mid.ms.gov> (or most up-to-date link)

Easier to locate Agent at MID when name agrees with MID licensed name.)

(Bond Agent MID or Code requirements are different from the Ins Cert Agent MID or Code requirements.)

SECTION 00650

**STANDARD CONSTRUCTION CONTRACT
CERTIFICATE OF INSURANCE**

This certificate of insurance neither affirmatively nor negatively amends, extends, or alters the coverage afforded by the policies below.

INSURED: (Contractor's Name & Address)				COMPANIES PROVIDING COVERAGE w/ MID Lic or NAIC #	
				A	#
				B	#
				C	#
				D	#
				E	#
				F	#
PROJECT: (Number, Name & Location)				G	#
				Companies above must be approved by the MS Ins Dept at https://www.mid.ms.gov (or most up-to-date link) per Code & WComp at http://www.mwcc.ms.gov (MID mod'd 041615)	
OWNER: Bureau of Building, Grounds & Real Property Management					
Type Insurance	Co	Policy Number	Policy Period	Coverage and Minimum Amount	
General Liability Commercial General Liability				General Aggregate	\$ 1,000,000
				Products Comp/Ops (Aggregate)	\$ 1,000,000
				Personal Injury (Per Occurrence)	\$ 500,000
				BI & PD (Per Occurrence)	\$ 1,000,000
				Fire Damage (Per Fire)	\$ 50,000
				Medical Expense (Per Person)	\$ 5,000
Owners/Contractors Protective Liability				General Aggregate	\$ 1,000,000
				Per Occurrence	\$ 500,000
Automobile Liability				Bodily Injury/Property Damage Combined Single Limit (Per Occurrence)	\$ 500,000
				OR Bodily Injury (Per Person)	\$ 250,000
				Bodily Injury (Per Accident)	\$ 500,000
			Property Damage (Per Occurrence)	\$ 100,000	
* Excess Liability (Umbrella on projects over \$500,000)				Aggregate	\$ 1,000,000
				Per Occurrence	\$ 1,000,000
Workers' Compensation (As required by Statute) Employers' Liability				Accident (Per Occurrence)	\$ 100,000
				Disease-Policy Limit	\$ 500,000
				Disease-Per Employee	\$ 100,000
Property Insurance (not required when project is demolition ONLY – required for ALL other projects including paving)				OR Builders' Risk	Must be equal to
				Installation Floater	Value of Work
Other					
Certification: I certify that these policies (subject to their terms, conditions and exclusions) have been (1) issued to the Insured for the coverages and at least the amounts as indicated by companies licensed in Mississippi; (2) countersigned by a Mississippi Licensed Agent; and (3) endorsed to require the company to give thirty (30) days written notice to the Owner prior to cancellation or non-renewal of above.					
Producing Agent: (Name, Address and Telephone)				(Signature) (Date) MID Lic # or countersign below	
				(Name and Title of Authorized Representative) (typed)	
				Agent must be approved by the MS Ins Dept or countersign https://www.mid.ms.gov	

Check if Mississippi Licensed Agent
OR Countersign by Mississippi Licensed Agent MID Lic # _____

Division 0

CERTIFICATE OF INSURANCE INSTRUCTIONS

SECTION 00650

1. The *Certificate of Insurance* is a tabulation of insurance required for this Project as specified in Article 11 entitled *Insurance and Bonds* in the General Conditions (AIA Document A201, Sixteenth Edition, 2007).
2. The *Certificate of Insurance* must be completed, certified by the original signature of a Mississippi Licensed Insurance Agent and/or countersignature, dated, and bound in each set of the Contract Documents. Insurance Companies providing coverage and Agent and/or Countersignature Agent must be approved by the Mississippi Insurance Department on their web at http://www.mid.state.ms.us/licapp/search_main.aspx <https://www.mid.ms.gov> (or most up-to-date link). (Agent does not have to be on the MID web “for providers necessarily” – but must be an approved Agent on MID web. Easier to locate Agent at MID when name agrees with MID licensed name.)
3. Indicate Insured, Project, Companies providing coverage, policy numbers and policy periods in the blanks as applicable.
4. If the "OWNERS/CONTRACTORS PROTECTIVE LIABILITY" insurance is part of the Commercial General Liability Insurance Policy, or included by endorsement, indicate the policy number and period of the CGL policy in the "OWNERS/CONTRACTORS PROTECTIVE LIABILITY" blank spaces.
5. Automobile Liability Insurance may be provided which covers Bodily Injury and Property Damage in one (1) Combined Single Limit, or may be provided with separate minimum limits as shown on the Certificate of Insurance and specified in Article 11 of the Supplementary Conditions. The person signing the Certificate of Insurance should show which option the Contractor has selected by marking out the coverage that is not provided under the policies indicated.
6. OTHER INSURANCE (if required) will be indicated by typing in the "OTHER" block and detailed in Article 11 of the Supplementary Conditions.
7. CERTIFICATION wording may not be changed without specific written approval from the Owner.
8. "Riders", Binders, TBA, TBD, or other unsolicited attachments, are not allowed as part of the *Certificate of Insurance* unless specifically requested in writing by the Owner, or specified as part of the requirements for this Project.
9. CAUTION: The *Certificate of Insurance* is intended to be used for all Projects. The Contractor must provide all insurance specified in the Contract Documents for this Project, whether indicated on this form, or not. The Contractor must verify all insurance has been provided as required.
10. In accepting the Insurance Certificate by Owner, it would be helpful if some indication is given when, and if, the Provider is a Surplus Line Carrier, a Broker, or Self Insured (because they may not be on the MID web list referenced herein). (The Owner will have to ask MID (or know) at some point.)
11. The Workers Comp insurance provider must be approved and show up on the Workers Comp web at <http://www.mwcc.state.ms.us / Services / Proof of Coverage Inquiry / accept / etc.> and at the last step – enter the “contractor’s name”.

Note: Regarding #2 and #11. At the MID web – you enter the Surety Company / Provider / Agent. At the MWWC web – you enter the Vendor’s name, then click on the policy number to see the MWWC Ins Provider.

*** END OF SECTION ***

GENERAL CONDITIONS
SECTION 00700

PART 1 - GENERAL

1.01 DESCRIPTION

- A. **SCOPE:** The **General Conditions of the Contract for Construction**, AIA Document A201, Sixteenth Edition, 2007, Articles 1 through 15 inclusive, is a part of this Contract and is incorporated herein.
- B. **BIDDING COPY:** For the purpose of bidding, Contractors are presumed to be familiar with AIA Document A201, a copy of which may be obtained from the Professional, or examined in the Professional's office.

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

2007 SUPPLEMENTARY CONDITIONS

SECTION 00800

PART 1 – GENERAL

1.01 DESCRIPTION

A. **Owner:** These supplements are necessary because the Owner is an agency, or political subdivision, of the State of Mississippi and occupies a different position from that of the usual Owner.

B. **Document:** The following supplements modify, change, delete from, or add to the **General Conditions of the Contract**, AIA Document A201, Sixteenth Edition, 2007. When any Article of the **General Conditions** is modified, or deleted, by these *Supplementary Conditions*, the unaltered provisions of that Article, Paragraph, Subparagraph, or Clause will remain in effect.

Article 1

GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1 **The Contract Documents:** Delete the last sentence of this Subparagraph and substitute the following sentence:

The Contract Documents include the Advertisement for Bids, Instructions to Bidders, Proposal Form, sample forms and all portions of addenda issued prior to execution of the Contract.

1.1.9 Add a new Subparagraph as follows:

COMMISSIONING AUTHORITY PROFESSIONAL

A professional independent of the project engineer or architect retained by the owner who manages a quality focused process for enhancing the delivery of the project. The process focuses upon verifying and documenting that the facility and all of its systems are planned, designed, installed, tested, operated, and maintained to meet the Owner's project requirements.

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

1.5.1 Add a new sentence at the end of this Subparagraph:

This Paragraph in no way supersedes the Owner's document rights set forth in the Agreement Between the Owner and the Professional.

1.5.3 Add a new Subparagraph as follows: (Added Sept-Dec 2013)

Transparency. In accordance with the Mississippi Accountability and Transparency Act of 2008, §27-104-151, et seq., of the Mississippi Code of 1972, as Amended, the American Accountability and Transparency Act of 2009 (P.L. 111-5), where applicable, and §31-7-13 of the Mississippi Code of 1972, as amended, where applicable, a fully executed copy of this agreement shall be posted to the State of Mississippi's accountability website at: <https://www.transparency.mississippi.gov>

Article 2

OWNER

Division 0

2.1 GENERAL

2.1.1 Change this Subparagraph to read as follows:

The Owner, as used in these Documents, refers to the Bureau of Building, Grounds and Real Property Management, acting for and on behalf of the State of Mississippi and for the benefit of the Institution, Agency, or Department for which the Work under this Contract is being performed. The Owner is the entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner's representative, who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization, is the individual who signed

the Construction Contract for the Owner. Except as otherwise provided in Subparagraph 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.2.5 Change this Subparagraph to read as follows:

Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, such copies of Drawings and Project Manuals as are reasonably necessary, but in no instance to exceed twenty-five (25) copies, for the execution of the Work.

Article 3 CONTRACTOR

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.1 Change the last sentence to read as follows:

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 Owner and Architect shall be responsible for any resulting loss or damage.

3.4 LABOR AND MATERIALS

3.4.4 Modify the Subparagraph as follows: (Modified Sept-Dec 2013)

Employee Status Verification System *If applicable, the Contractor represents and warrants that it will ensure its compliance with the Mississippi Employment Protection Act, Section 71-11-1, et seq. of the Mississippi Code Annotated (Supp 2008), and will register and participate in the status verification system for all newly hired employees. The term "employee" as used herein means any person that is hired to perform work within the State of Mississippi. As used herein, "status verification system" means the Illegal Immigration Reform and Immigration Responsibility Act of 1996 that is operated by the United States Department of Homeland Security, also known as the E-Verify Program, or any other successor electronic verification system replacing the E-Verify Program. The Contractor agrees to maintain records of such compliance and, upon request of the State and approval of the Social Security Administration or Department of Homeland Security, where required, to provide a copy of each such verification to the State. The Contractor further represents and warrants that any person assigned to perform services hereunder meets the employment eligibility requirements of all immigration laws of the State of Mississippi. The Contractor understands and agrees that any breach of these warranties may subject the Contractor to the following: (a) termination of this Agreement and ineligibility for any state or public contract in Mississippi for up to three (3) years, with notice of such cancellation/termination being made public, or (b) the loss of any license, permit, certification or other document granted to the Contractor by an agency, department or governmental entity for the right to do business in Mississippi for up to one (1) year, or (c) both. In the event of such cancellation/termination, the Contractor would also be liable for any additional costs incurred by the State due to the contract cancellation or loss of license or permit.*

3.4.5 Add a new Subparagraph as follows: (Modified Sept-Dec 2013)

In providing labor for the proper execution and completion of the Work, the Contractor shall comply with the provisions of Section 31-5-17 and Section 31-5-19 of the Mississippi Code of 1972, Annotated.

3.4.6 Add a new Subparagraph as follows: (Modified Sept-Dec 2013)

In providing materials for the proper execution and completion of the Work, the Contractor shall comply with the provisions of Section 31-5-23 of the Mississippi Code of 1972, Annotated.

Division 0

3.9 **SUPERINTENDENT**

3.9.2 Change the second line in this Subparagraph to read as follows:

The Architect shall, within a reasonable time, notify the Contractor in writing of any objection to the proposed superintendent.

3.15 **CLEANING UP**

3.15.2 Change this Subparagraph to read as follows:

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

3.16 **ACCESS TO WORK**

Change this Paragraph to read as follows:

The Contractor shall provide the Owner, Architect, Commissioning Authority Professional, and their authorized representatives access to the Work in preparation and progress wherever located.

3.18 **INDEMNIFICATION**

3.18.3 Modify the Subparagraph as follows: (Modified Sept-Dec 2013)

***Indemnification** To the fullest extent allowed by law, Contractor shall indemnify, defend, save and hold harmless, protect, and exonerate the State of Mississippi, its Commissioners, Board Members, officers, employees, agents, and representatives from and against all claims, demands, liabilities, suits, actions, damages, losses, and costs of every kind and nature whatsoever, including, without limitation, court costs, investigative fees and expenses, and attorneys' fees, arising out of or caused by Contractor's and/or its partners, principals, agents, employees, and/or subcontractors in the performance of or failure to perform this Agreement. In the State's sole discretion, Contractor may be allowed to control the defense of any such claim, suit, etc. In the event Contractor defends said claim, suit, etc., Contractor shall use legal counsel acceptable to the State; Contractor shall be solely liable for all reasonable costs and/or expenses associated with such defense and the State shall be entitled to participate in said defense. Contractor shall not settle any claim, suit, etc., without the State's concurrence, which the State shall not unreasonably withhold.*

Article 4
ARCHITECT

4.1 **GENERAL**

4.1.4 Add a new Subparagraph as follows:

The term "Architect," "Engineer," or "Professional" as used in these Documents refers to the Professional firm indicated in Paragraph 5.3.1 of the Standard Form of Agreement Between the Owner and the Contractor who has been directed by the Owner to design and inspect construction of this Project.

4.2 **ADMINISTRATION OF THE CONTRACT**

4.2.1 Change the first line of this Subparagraph to read as follows:

The Architect will provide administration of the Contract as described in the Contract Documents, and will be the Owner's representative (1) during construction, (2) until the final payment is due and (3) with the Owner's concurrence, from time to time during the one year period for correction of Work described in Section 12.2.

Article 5

Division 0

SUBCONTRACTORS

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

5.2.1 Change the first line of this Subparagraph to read as follows: (modified Jan 2015) (see also 600.55; Div 1-01010.1.01.F)

Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, prior to award of the Contract by the Owner, shall furnish in writing to the Owner through the Professional, the names, disciplines, and COR #'s of Sub-Contractors over Fifty Thousand Dollars (\$50,000.00) (as well as entities who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. Such list shall also include any Mechanical, Plumbing, or Electrical Sub-Contractor listed on Proposal Form regardless of amount.

Article 6

CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

No supplementary conditions.

Article 7

CHANGES IN THE WORK

7.2 CHANGE ORDERS

7.2.2 Add a new Subparagraph as follows:

The maximum cost included in a Change Order for profit and overhead is limited to twenty percent (20%) of the total of the actual cost for materials, labor and subcontracts. Profit and overhead include: all taxes, fees, permits, insurance, bond, job superintendent, job and home office expense. All Subcontractors shall acquiesce to the same requirements when participating in a Change Order.

7.3 CONSTRUCTION CHANGE DIRECTIVES

7.3.9 Delete this Subparagraph in its entirety.

Article 8

TIME

8.1 DEFINITIONS

8.1.2 Change this Subparagraph to read as follows:

The date of commencement of the Work is the date established in the Notice to Proceed.

8.3 DELAYS AND EXTENSIONS OF TIME

8.3.1 Change this Subparagraph to read as follows:

If the Contractor is delayed at any time in the commencement or progress of the Work by any act of neglect of the Owner or the Architect, or by any employee of either, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or any causes beyond the Contractor's control, or by any other causes which the Architect determines may justify the delay, then the Contract Time may be extended by Change Order for such reasonable time as the Architect may determine, subject to the Owner's approval. Any claim for loss or any delay occasioned by any separate Contractor, or Subcontractor, shall be settled between the Contractor and such other separate Contractor, or Subcontractors.

Article 9

Division 0

PAYMENTS AND COMPLETION

9.2 SCHEDULE OF VALUES

Change this Paragraph to read as follows:

Where the Contract is based on a stipulated sum, the Contractor shall submit to the Architect, at least 10 days 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 or Owner, shall be used as a basis for reviewing the Contractor's Applications for Payment.

9.3 APPLICATIONS FOR PAYMENT

9.3.1 Add a new sentence to the end of this Subparagraph:

The form of Application for Payment will be AIA Document G702, Application and Certification for Payment, supported by AIA Document G703, Continuation Sheet, or a computer generated form containing similar data.

9.3.1.1 Delete this Subparagraph in its entirety.

9.3.1.3 Add a new Clause to Subparagraph 9.3.1 as follows: (see also Manual 700.28) (modified Sept-Dec 2013)

On any contract as described herein, of which the total amount is Two Hundred Fifty Thousand Dollars (\$250,000.00) or greater, or on any contract with a subcontractor, regardless of amount, five percent (5%) shall be retained until the Work is at least fifty percent (50%) complete, on schedule and satisfactory in the architect's and/or engineer's opinion, at which time fifty percent (50%) of the retainage held to date shall be returned, subject to consent of surety, to the prime contractor for distribution to the appropriate subcontractors and suppliers; provided, however, that future retainage shall be withheld at the rate of two and one-half percent (2 1/2%). When submitting request for reduction in retainage, the Contractor will include, with the application, a Consent of Surety to Reduction which is AIA Form G707A, and a Power of Attorney. (Code 31-5-33)

9.3.1.4 Add a new Clause to Subparagraph 9.3.1 as follows:

The Contractor must submit each month with this Application for Payment a separate letter stating that he is requesting an extension of time or that he had no need for an extension for that period of time. No payment on a monthly application will be considered due and payable until the letter is received. Complete justification such as weather reports or other pertinent correspondence must be included for each day's request for extension. A Contractor's letter, or statement, will not be considered as adequate justification. The receipt of this request and data by the Owner will not be considered as Owner approval in any way.

9.3.2.1 Add a new Clause to Subparagraph 9.3.2 as follows:

Payment on materials stored at some location other than the building site, may be approved by the Architect and the Owner after the Contractor has submitted the following items:

- .1 An acceptable Lease Agreement between the General Contractor and the owner of the land, or building, where the materials are stored covering the specific area where the materials are located.*
- .2 Consent of Surety, or other acceptable Bond, to cover the materials stored off-site.*
- .3 All Perils Insurance coverage for the full value of the materials stored off-site.*
- .4 A Bill of Sale from the Manufacturer to the General Contractor for the stored materials.*
- .5 A complete list and inventory of materials manufactured, stored and delivered to the storage site and of materials removed from the storage site and delivered to the job site.*
- .6 A review by the Architect of the materials stored off-site prior to release of payment.*
- .7 Guarantee no storage costs, additional delivery fees, or subsequent costs to the Owner.*

Division 0

9.5 **DECISIONS TO WITHHOLD CERTIFICATION**

9.5.3 Delete this Subparagraph in its entirety.

9.6 **PROGRESS PAYMENTS**

9.6.2 Change the first line of this Subparagraph to read as follows:

The Contractor shall pay each Subcontractor, in accordance with Section 31-5-27 of the Mississippi Code 1972, Annotated, 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.

9.6.8 Add a new Subparagraph as follows:

The amount retained by the Contractor from each payment to each Subcontractor and material supplier will not exceed the percentage retained by the Owner from the Contractor.

9.6.8.1 Add a new Clause to Subparagraph 9.6.8 as follows:

The Contractors shall submit monthly certification, in accordance with Section 31-5-25 of the Mississippi Code 1972, Annotated, on Owner's "Affidavit Certifying Payment to All Subcontractors" form, to the project engineer or architect indicating payments to subcontractors on prior payment request. (attached as Exhibit "A" at the end of Division 0 Section 00800 herein)

9.6.9 Modify the Subparagraph as follows: (Modified Sept-Dec 2013; SAAS modified 092414)

The DFA agrees to make payment in accordance with Mississippi law on "Timely Payments for Purchases by Public Bodies", Section 31-7-301, et seq. of the Mississippi Code of 1972, as amended, which generally provides for payment of undisputed amounts within forty-five (45) days of receipt of the invoice. The State requires the Contractor to submit invoices electronically throughout the term of the agreement. Vendor invoices shall be submitted to the state agency using the processes and procedures identified by the State. Payments by state agencies using the statewide electronic payment and remittance vehicle shall be made and remittance information provided electronically as directed by the State. These payments shall be deposited into the bank account of the Contractor's choice. Contractor understands and agrees that the State is exempt from the payment of taxes. All payments shall be in United States currency. No payment, including final payment, shall be construed as acceptance of defective or incomplete work, and the Contractor shall remain responsible and liable for full performance.

E-payments will continue but the Bureau of Building, Grounds and Real Property Management received a Waiver for the underlined sentence above dated June 13, 2009, for the e-invoice / electronic invoice, and said waiver is recorded in the Bureau General Business Minutes.

9.7 **FAILURE OF PAYMENT**

Change this Paragraph to read as follows:

The Contractor and the Owner shall be subject to the remedies as prescribed in Section 31-5-25 of the Mississippi Code 1972, Annotated.

9.8 **SUBSTANTIAL COMPLETION**

9.8.1 Add the following sentence to the end this Subparagraph to read as follows:

Commissioning requirements must be complete except for thermographs of electrical systems, trend log monitoring, seasonal testing, near-warranty end activities and verification of training sessions.

9.8.4 Change the first line this Subparagraph to read as follows:

Division 0

When the Work or designated portion thereof is substantially complete and affirmed by the Owner, 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 Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate.

9.10 FINAL COMPLETION AND FINAL PAYMENT

9.10.1 Change this Subparagraph to read as follows:

When, in the opinion of the Contractor, the Work is ready for final inspection and acceptance by the Owner, the Contractor shall make such notice to the Architect in writing.

- 1. Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance by the Owner, the Architect will promptly inspect the Work and compile a list of deficiencies. If, in the Architect's judgment, the Work is not ready for inspection, another inspection will be scheduled.*
- 2. Once the Architect has made inspection and all deficiencies listed by the Architect have been corrected and the Architect determines the Work is ready for final inspection, the Architect will call for final inspection of the Project with the Owner for the purpose of determining whether the Work is acceptable under the Contract Documents.*
- 3. The final inspection shall be conducted in the presence of the Owner and a list of defects or discrepancies, if any, will be compiled into a punch list furnished to all parties.*
- 4. Once corrections of all punch list items have been confirmed by the Architect, the Architect will provide a letter recommending final acceptance of the Work to the Owner.*

9.10.2 Change this Subparagraph to read as follows:

Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) final application for payment, (2) consent of surety to final payment, (3) power of attorney, (4) Contractor's affidavit of release of liens, (5) Contractor's affidavit of payment of debts and claims, (6) Contractor's guarantee of work, (7) Project Record Documents and (8) certificates, warranties, guarantees, bonds or documents as called for in the individual sections of the Project Manual.

9.11 LIQUIDATED DAMAGES

9.11.1 Add a new Paragraph as follows:

Time being of the essence and a matter of material consideration thereof, a reasonable estimate in advance is established to cover losses incurred by the Owner if the project is not substantially complete on the date set forth in the Contract Documents. The Contractor and his Surety will be liable for and will pay the Owner the sums stipulated in Paragraph 2.2 of the Standard Form of Agreement Between the Owner and the Contractor as fixed and agreed as liquidated damages for each calendar day of delay until the work is substantially complete unless circumstances dictate otherwise in the discretion of the Owner.

Article 10
PROTECTION OF PERSONS AND PROPERTY

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.5 Change this Subparagraph to read as follows:

The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Clauses 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 for Clauses 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect 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 Paragraph 3.18.

Division 0

10.3 **HAZARDOUS MATERIALS**

10.3.2 Delete this Subparagraph in its entirety.

10.3.3 Delete this Subparagraph in its entirety.

10.3.4 Delete this Subparagraph in its entirety.

10.3.5 Delete this Subparagraph in its entirety.

10.3.6 Delete this Subparagraph in its entirety.

Article 11
INSURANCE AND BONDS

11.1 **CONTRACTOR'S LIABILITY INSURANCE**

11.1.4 Delete this Subparagraph in its entirety.

11.1.5 Add a new Subparagraph as follows: Modified 11.1.5.1 BI and PD on 030116 per Code 31-5-51(7) and 31-7-13(v)

The Contractor's limits of liability shall be written for not less than the following:

.1 GENERAL LIABILITY:

*Commercial General Liability
(Including XCU)*

<i>General Aggregate.....</i>	<i>\$ 1,000,000.00 Aggregate</i>
<i>Products & Completed Operations</i>	<i>\$ 1,000,000.00 Aggregate</i>
<i>Personal & Advertising Injury.....</i>	<i>\$ 500,000.00 Per Occurrence</i>
<i>Bodily Injury & Property Damage</i>	<i>\$ 1,000,000.00 Per Occurrence</i>
<i>Fire Damage Liability</i>	<i>\$ 50,000.00 Per Occurrence</i>
<i>Medical Expense</i>	<i>\$ 5,000.00 Per Person</i>

.2 OWNERS & CONTRACTORS PROTECTIVE LIABILITY:

<i>Bodily Injury & Property Damage</i>	<i>\$ 1,000,000.00 Aggregate</i>
<i>Bodily Injury & Property Damage</i>	<i>\$ 500,000.00 Per Occurrence</i>

.3 AUTOMOBILE LIABILITY:

(Owned, Non-owned & Hired Vehicles)

Contractor Insurance Option Number 1:

<i>Bodily Injury & Property Damage</i>	<i>\$ 500,000.00 Per Occurrence</i>
--------------------------------------------------	-------------------------------------

(Combined Single Limit)

Contractor Insurance Option Number 2:

<i>Bodily Injury</i>	<i>\$ 250,000.00 Per Person</i>
<i>Bodily Injury</i>	<i>\$ 500,000.00 Per Accident</i>
<i>Property Damage.....</i>	<i>\$ 100,000.00 Per Occurrence</i>

.4 EXCESS LIABILITY:

(Umbrella on projects over \$500,000)

<i>Bodily Injury & Property Damage</i>	<i>\$ 1,000,000.00 Aggregate</i>
--------------------------------------------------	----------------------------------

(Combined Single Limit)

Division 0

.5 **WORKERS' COMPENSATION:**

(As required by Statute)

EMPLOYERS' LIABILITY:

Accident.....	\$	100,000.00 Per Occurrence
Disease.....	\$	500,000.00 Policy Limit
Disease.....	\$	100,000.00 Per Employee

.6 **PROPERTY INSURANCE:**

Builder's Risk	\$	Equal to Value of Work
or		
Installation Floater	\$	Equal to Value of Work

11.1.6 Add a new Subparagraph as follows:

Furnish one (1) copy of the Standard Construction Contract Certificate of Insurance Form for each copy of the Standard Form of Agreement Between Owner and Contractor specifically setting forth evidence of all coverage required by Subparagraphs 11.1.1, 11.1.2 and 11.1.3. Furnish to the Owner copies of any endorsements that are subsequently issued amending limits of coverage.

11.1.7 Add a new Subparagraph as follows:

If the coverages are provided on a claims-made basis, the policy date or retroactive date shall predate the Contract; the termination date, or the policy, or applicable extended reporting period shall be no earlier than the termination date of coverages required to be maintained after final payment.

11.2 **OWNER'S LIABILITY INSURANCE**

Delete this Paragraph in its entirety and substitute the following:

The Contractor shall purchase and maintain such insurance as will protect the Owner from his contingent liability to others for damages because of bodily injury, including death, and property damage, which may arise from operations under this Contract and other liability for damages which the Contractor is required to insure under any provision of this Contract. Certificate of this insurance will be filed with the Owner and will be the same limits set forth in 11.1.5.

11.3 **PROPERTY INSURANCE (BUILDER'S RISK OR INSTALLATION FLOATER)**

11.3.1 Change the first line in this Subparagraph to read as follows:

The Contractor shall purchase....

11.3.1.2 Delete this Clause under Subparagraph 11.3.1 in its entirety.

11.3.1.3 Change the following Clause in this Subparagraph to read as follows:

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

11.3.2 Delete this Subparagraph in its entirety.

11.3.3 Delete this Subparagraph in its entirety.

11.3.4 Delete this Subparagraph in its entirety.

11.3.5 Delete this Subparagraph in its entirety.

11.3.6 Delete this Subparagraph in its entirety.

11.3.10 Change this Subparagraph to read as follows:

Division 0

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 (5) days after occurrence of loss.

Article 12
UNCOVERING AND CORRECTION OF WORK

No supplementary conditions.

Article 13
MISCELLANEOUS PROVISIONS

13.1 GOVERNING LAW

Change this Paragraph to read as follows:

The Contract shall be governed by the laws of the State of Mississippi.

13.5 TESTS AND INSPECTIONS

13.5.1 Change the third line of this Subparagraph by adding “*and Commissioning Authority Professional*” after each instance of the word “*Architect*”.

13.5.3 Change this Subparagraph by inserting “*and the Commissioning Authority Professional’s*” after the word “*Architect*”.

13.5.5 Change this Subparagraph by adding “*and/or the Commissioning Authority Professional*” after each instance of the word “*Architect*”.

13.7 Change this Paragraph title and contents to read as follows: (modified Sept-Dec 2013)

13.7 COMMENCEMENT OF STATUTORY LIMITATION PERIOD

13.7.1 *The Owner and Contractor shall commence all claims and causes of action within the time period specified by applicable state law.*

Article 14
TERMINATION OR SUSPENSION OF THE CONTRACT

No supplementary conditions.

Article 15
CLAIMS AND DISPUTES

15.2 INITIAL DECISION

15.2.1 Change this Subparagraph to read as follows:

Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker. An initial decision by the Initial Decision Maker shall be required as a condition precedent to arbitration or litigation of all Claims between the Contractor and Owner arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered by the Initial Decision Maker. The Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

15.2.5 Change the last line of this Subparagraph to read as follows:

The initial decision shall be final and binding on the parties but subject to arbitration or litigation.

Division 0

15.2.6 Delete this Subparagraph in its entirety.

15.2..6.1 Delete this Clause in its entirety.

15.3 **MEDIATION**

15.3.1 Delete this Subparagraph in its entirety.

15.3.2 Delete this Subparagraph in its entirety.

15.3.3 Delete this Subparagraph in its entirety.

15.4 **ARBITRATION**

15.4.1 Delete this Subparagraph in its entirety.

15.4.1.1 Delete this Clause in its entirety.

15.4.1.2 Delete this Clause in its entirety.

15.4.2 Delete this Subparagraph in its entirety.

15.4.3 Delete this Subparagraph in its entirety.

15.4.4 Delete this Subparagraph in its entirety.

15.5 Add a new Paragraph as follows:

ARBITRATION PROCEDURES FOR THE DEPARTMENT OF FINANCE AND ADMINISTRATION'S BUREAU OF BUILDING, GROUNDS AND REAL PROPERTY MANAGEMENT

All matters of dispute arising out of any agreement with the Department of Finance and Administration for planning, design, engineering, construction, erection, repair, or alteration of any building, structure, fixture, road, highway, utility or any part thereof, or any agreement with the Department of Finance and Administration for architectural, engineering, surveying, planning, and related professional services which provides for mediation or arbitration, shall comply with the following course for resolution. No arbitration hearing shall be granted on any claim in excess of One Hundred Thousand Dollars (\$100,000.00).

15.5.1 Add a new Subparagraph as follows:

CONDITIONS PRECEDENT TO ARBITRATION

.1 The aggrieved party must first notify opposing party in writing in detail of the matter(s) in dispute the amount involved and the remedy sought. Such writing shall include copies of any documents, writings, plans, or other matter pertinent to the resolution of the dispute. The Director of the Bureau of Building and a principal of the opposing party shall be the proper parties for such notice and shall be active parties in any subsequent dispute resolution.

.2 If the dispute cannot be satisfactorily resolved, within thirty (30) days of the complaint being rejected in writing by either party, notice by certified mail shall be given to the Deputy Director of the Department of Finance and Administration. A copy of the notice shall be sent by certified mail to the opposing party. Such notice shall be in writing setting forth in detail the matter(s) in dispute, the amount involved, the remedy sought and state that informal resolution between the parties cannot be reached. Such writing shall include copies of any documents, writings, plans, or other matter pertinent to the resolution of the dispute. Opposing party shall have the opportunity to set forth in writing a rebuttal with pertinent documents attached. At the sole discretion of the Deputy Director, oral testimony may be had on the matter.

15.5.2 Add a new Subparagraph as follows:

Division 0

REQUESTS FOR ARBITRATION: *Within thirty (30) days of a claim being rejected in writing by the Deputy Director of the Department of Finance and Administration, either party may request arbitration. Notices for requests for arbitration shall be made in writing to the Executive Director of the Department of Finance and Administration, P.O. Box 267, Jackson, MS 39201. Such notice shall set forth in detail the matter(s) in dispute, the amount involved, and the remedy sought. A copy of the request shall be mailed to the opposite party. The party requesting arbitration must deposit the sum of two hundred (\$200.00) with its request as a deposit against costs incurred by the arbitrators. Each party will be notified in writing in any manner provided by law of certified mail not less than twenty (20) days before the hearing of the date, time and place for the hearing. Appearance at the hearing waives a party's right to notice.*

15.5.3 Add a new Subparagraph as follows:

SELECTION OF ARBITRATORS: *Upon request for arbitration, a panel of three (3) arbitrators shall be chosen. One (1) member shall be appointed by the Executive Director of the Department of Finance and Administration. One (1) member shall be appointed by the executive director of a professional or trade association which represents interests similar to that of the non-state party. The third member shall be appointed by the first two.*

15.5.4 Add a new Subparagraph as follows:

HEARINGS: *All hearings shall be open to the public. All hearings will be held in Jackson, Mississippi, unless another location is mutually agreed to by the parties. The hearings shall be conducted as prescribed by **Mississippi Code 1972, Annotated**, Sections 11-15-113, 11-15-115, and 11-15-117. A full and complete record of all proceedings shall be taken by a certified court reporter. The scheduling and cost of retaining the court reporter shall be the responsibility of the party requesting arbitration. The costs of transcription of the record shall be the responsibility of the party requesting such transcript. No arbitration hearing shall be held without a certified court reporter. Deliberations of the arbitrators shall not be part of the record.*

15.5.5 Add a new Subparagraph as follows:

AWARDS: *Awards shall be made in writing and signed by the arbitrators joining in the award. A copy of the award shall be delivered to the parties by certified mail.*

15.5.6 Add a new Subparagraph as follows:

FEES AND EXPENSES: *Reasonable fees and expenses, excluding counsel fees, incurred in the conduct of the arbitration shall be at the discretion of the Arbitrator except each party shall bear its own attorney's fees and costs of expert witnesses.*

15.5.7 Add a new Subparagraph as follows:

MODIFICATIONS, CONFIRMATIONS, AND APPEALS: *All modifications, confirmations and appeals shall be as prescribed by **Mississippi Code 1972, Annotated**, Section 11-15-123 et seq. All awards shall be reduced to judgment and satisfied in the same manner other judgments against the State are satisfied.*

15.5.8 Add a new Subparagraph as follows:

SECRETARY FOR THE ARBITRATORS: *All notices, requests, or other correspondence intended for the arbitrators shall be sent to Executive Director, Department of Finance and Administration, P.O. Box 267, Jackson, MS 39201.*

**AFFIDAVIT CERTIFYING
PAYMENT TO ALL SUBCONTRACTORS**

Department of Finance and Administration
Bureau of Building, Grounds and Real Property Management

I acknowledge that, pursuant to Miss. Code Ann. §31-5-25 and H.B. 1562, Laws of 2002, that I am required to submit monthly certification indicating payments to subcontractors on prior payment requests. I, the undersigned Contractor, do hereby certify that I have paid the following amounts to subcontractors for Work which has been performed and incorporated into previous Applications for Payment which were issued and payment received from the Owner on the project listed below. I understand that this document must be submitted on a monthly basis after the submittal, approval and payment of Application for Payment #1. I understand that the Bureau of Building reserves the right to require me, the undersigned, to provide verification of payment and/ or additional information.

Division 0
Section 00800 SUPPLEMENTARY CONDITIONS
Article 9.6 Progress Payments
Article 9.6.8.1

Pursuant to Code §31-5-25 and HB1562, Laws of 2002
...Contractors shall submit monthly certification to the project engineer or architect indicating payments to subcontractors on prior payment request. . . .

Project Name and Number: _____

Using Agency: _____

Subcontractor: _____ Amount: \$ _____

Subcontractor: _____ Amount: \$ _____

Subcontractor: _____ Amount: \$ _____

Subcontractor: _____ Amount: \$ _____

Subcontractor: _____ Amount: \$ _____

Subcontractor: _____ Amount: \$ _____

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Subcontractor: _____ Amount: \$ _____
Subcontractor: _____ Amount: \$ _____

(Attach additional list of subcontractors and amounts, if necessary)

Contractor Name and Title: _____
Contractor Certificate of Responsibility Number: _____
Contractor Signature: _____ Date: _____

STATE OF MISSISSIPPI

COUNTY OF _____

SWORN TO AND SUBSCRIBED BEFORE ME, the undersigned notary public,
this the _____ day of _____, 20____.

NOTARY PUBLIC

My Commission Expires:

LABOR REQUIREMENTS

SECTION 00820

PART 1 - EQUAL OPPORTUNITY

1.01 GENERAL

The Contractor will maintain policies of employment as follows:

- A. The Contractor and all Subcontractors will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin or age. The Contractor will take affirmative action to insure that applicants are employed and that employees are treated during employment without regard to their race, religion, color, sex, national origin, or age. Such action will include, but not be limited to the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.
- B. The Contractor and all Subcontractors will, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants receive consideration for employment without regard to race, religion, color, sex, national origin or age.

PART 2 – FEDERAL REQUIREMENTS

2.01 APPLICABILITY

When project funding includes Federal funds, the applicable Federal Labor Standards Provisions will be included herein, to which the Contractor, and all Subcontractors, shall be subject to. Where no such pages are included, then no special provisions shall apply.

PART 3 - WAGE RATES

3.01 GENERAL

When project funding includes Federal funds, the applicable Federal Government Wage Determinations will be included herein, to which the Contractor, and all Subcontractors, shall be subject to. Where no such pages are included, then no special wages shall apply.

ADDENDA
SECTION 00900

1.01 **ADDENDA**

Any Addendum issued on this Project will be included in Section 00900 and become a part of the *Standard Form of Agreement Between the Owner and*

SUMMARY OF WORK

SECTION 01010

1.01 WORK COVERED BY CONTRACT DOCUMENTS

- A. **Work Covered:** Work covered by the Contract Documents is as shown in drawings and described in words in the Project Manual. The Project Title and location is indicated on the first page of this Project Manual.
- B. **Start of Work:** Work shall be started immediately upon issuance of a *Notice to Proceed*. Prior to this, all Contracts and beginning documents will have been executed and insurance in force.
- C. **Time of Completion:** The completion of this Work is to be on, or before, the time indicated in the *Standard Form of Agreement Between the Owner and the Contractor*.
- D. **Contractor's Duties:**
1. Except as specifically noted, provide and pay for:
 - a. Labor, materials and equipment.
 - b. Tools, construction equipment and machinery.
 - c. Water, heat and utilities required for construction.
 - d. Other facilities and services necessary for proper execution and completion of the Work.
 2. Pay legally required sales, consumer, use, payroll, privilege and other taxes.
 3. Secure and pay for, as necessary for proper execution and completion of work, and as applicable at the time of the receipt of the bids:
 - a. Permits.
 - b. Government fees.
 - c. Licenses.
 4. Give required notices.
 5. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on performance of work.
 6. Promptly submit written notice to Professional of observed variance of Contract Documents from legal requirements. It is not the Contractor's responsibility to make certain that drawings and specifications comply with codes and regulations. Appropriate modifications to Contract Documents will adjust necessary changes. Assume responsibility for work known to be contrary to such requirements, without notice.
 7. Enforce strict discipline and good order among employees. Do not employ or work unfit persons, or persons, not skilled in assigned task.
 8. Provide a written safety plan.
- E. **Hazardous Materials:** The Prime General Contractor is responsible for the removal and disposal of any hazardous materials encountered in the performance of the Contract requirements. Hazardous Containing Materials [HCM] include, but are not limited to, Asbestos and Lead Paint and should be identified and removed as a part of the Contract. The absence of details does not relieve the Prime General Contractor from the responsibility of removal and disposal; but, a Change Order could be executed in the absence of identified HCM in the documents.
- F. **Subcontractor's List:** The Prime General Contractor will submit to the Owner a list of all Subcontractors, including disciplines and COR #'s, over Fifty Thousand Dollars (\$50,000.00) to be used on the Project ~~within~~ prior to contract award by the Owner. Any Sub-Contractor listed must be acceptable to the Owner. Additionally, include any Mechanical, Plumbing, or Electrical Sub-Contractor listed on Proposal Form regardless of amount.
(Modified Jan 2015) (see also 600.55; Div 0-5.2.1)
The Prime General Contractor will submit to the Owner within seven (7) days from the Notice to Proceed, a completed *Minority Tracking Form* (attached as Exhibit "A" at the end of Division 1 Section 01900) outlining the use of minority subcontractors that will be used on the project.
- G. **Coordination:** The Prime General Contractor is responsible for the coordination of the total project. All other

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Prime Contractors and all Subcontractors will cooperate with the Prime General Contractor so as to facilitate the general progress of the Work. Each trade shall afford all other trades every reasonable opportunity for the installation of their work. Refer to Section 01041 entitled *Project Coordination*.

1.02 **CONTRACTS**

Contracts: Construct work under a single Prime General Contract. Refer to Section 00500 entitled *Standard Form of Agreement Between the Owner and the Contractor*.

1.03 **WORK BY OTHERS**

Work by Others shall be described in each appropriate Project Manual section and noted on the Drawings.

1.04 **OWNER-FURNISHED PRODUCTS**

- A. **Products Furnished By Owner:** Products furnished by Owner shall be described in each appropriate Project Manual section and noted on the Drawings.
- B. **Products:** Delivered and unloaded at site.
- C. **Owner's Duties:**
 - 1. Schedule delivery date with Supplier in accordance with construction schedule.
 - 2. Obtain installation drawings and instructions.
 - 3. Submit claims for transportation damages.
 - 4. Arrange Guarantees, Warranties, etc..
- D. **Contractor's Duties:**
 - 1. Designate required delivery date for each product in construction schedule.
 - 2. Promptly inspect delivered products, report missing, damaged, or defective items.
 - 3. Handle at site, including uncrating and storage.
 - 4. Protect from exposure to elements and from damage.
 - 5. Repair or replace damaged items resulting from Contractor's operations.
 - 6. Install and make final connections.

1.05 **CONTRACTOR'S USE OF PREMISES**

- A. Confine operations at site to areas permitted by:
 - 1. Law.
 - 2. Ordinances.
 - 3. Permits.
 - 4. Contract Documents.
 - 5. Owner.
- B. Do not unreasonably encumber site with materials or equipment.
- C. Do not load structure with weight that will endanger structure.
- D. Assume full responsibility for protection and safekeeping of products stored on premises.
- E. Move any stored products which interfere with operations of Owner or other Contractors.
- F. Obtain and pay for use of additional storage or work areas needed for operations.
- G. Limit use of site for work and storage to the area indicated in the drawings.

1.06 **SUMMARY OF WORK SUPPLEMENT**

- A. Refer to Section 01900 entitled *Division One Supplement* for Project specific summary of work requirements.

Division One

ALLOWANCES

SECTION 01020

1.01 **DESCRIPTION**

- A. **Related Work Specified Elsewhere:** Sections of Specifications as listed under Schedule of Allowances.

- B. **Allowances for Products:**
 - 1. Purchase products under each allowance as directed by the Professional.
 - 2. Amount of each allowance includes:
 - a. Net cost of product.
 - b. Delivery and unloading at site.
 - c. Applicable taxes.
 - 3. In addition to amounts of allowances, include in bid, for inclusion in Contract sum, Contractor's costs for:
 - a. Handling at site, including uncrating and storage.
 - b. Protection from elements and damage.
 - c. Labor, installation and finishing.
 - d. Other expenses required to complete installation.
 - e. Overhead and profit.

- C. **Selection of Products:**
 - 1. **Architect's Duties:** Consult with Contractor in consideration of products and Suppliers; make selections, designate products to be used; and, notify Contractor in writing.
 - 2. **Contractor's Duties:** Assist Professional in determining qualified Suppliers; obtain proposals from Suppliers when requested by the Professional; and, make appropriate recommendations for consideration of the Professional. Upon notification of selection, enter into Purchase Agreement with designated Supplier.

- D. **Delivery:** The Contractor is responsible for arranging all delivery and unloading and should promptly inspect products for damage or defects and submit claims for transportation damage.

- E. **Installation:** Comply with requirements of referenced specification section.

- F. **Adjustment of Costs:** Should actual purchase cost be more, or less, than the specified allowance amount, the Contract Sum will be adjusted by Change Order equal to the amount of the difference.

1.02 **SCHEDULE OF ALLOWANCES**

- A. Refer to Section 01900 entitled *Division One Supplement* for Project specific Schedule of Allowances.

SCHEDULE OF VALUES

SECTION 01025

1.01 **DESCRIPTION**

- A. **Scope:** Submit a *Schedule of Values* to the Professional at least ten (10) days prior to submitting the first Application for Payment. Upon the Professional's request, the Contractor will provide supportive data substantiating their correctness. Use *Schedule of Values* only as basis for Contractor's Application for Payment.

- B. **Form of Submittal:** Submit Schedule of Values on AIA Document G703, or computer generated form containing similar style, using Table of Contents of these Specifications as basis for format for listing costs of work for sections under Divisions 2-16. Identify each line item with number and title as listed in Table of Contents in these Specifications.

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- C. **Preparing Schedule of Values:**
1. Itemize separate line item cost for each of the following general cost items: Performance and Payment Bonds, field supervision and layout, temporary facilities and controls.
 2. Itemize separate line item cost for work required by each Section of these Specifications. Break down installed cost with overhead and profit.
 3. For each line item which has installed value of more than \$20,000, break down costs to list major products for operations under each item, rounding figures to nearest dollar. Make sum of total costs of all items listed in Schedule equal to total Contract sum.
- D. **Preparing Schedule of Unit Material Values:**
1. Submit separate Schedule of unit prices for materials to be stored on which progress payments will be made. Make form of submittal parallel to Schedule of Values with each line item identified same as line item in Schedule of Values. Include in unit prices only: cost of material, delivery, unloading at site, and sales tax.
 2. Make sure unit prices multiplied by quantities equal material cost of that item in Schedule of Values.
- E. **Review and Resubmittal:** After Professional's review, if requested, revise and resubmit Schedule of Values in same manner.

APPLICATIONS FOR PAYMENT

SECTION 01027

1.01 SCOPE

- A. This Section describes procedures for preparing and submitting Applications for Payment by the Contractor.

1.02 APPLICATIONS FOR PAYMENT

- A. **Format:**
1. Applications for Payments will be prepared on AIA forms G702 - *Application and Certificate for Payment* and G703 - *Continuation Sheet*; or, a computer generated form containing similar data may be used.
- B. **Preparation of Application:**
1. Present required information in typewritten form
 2. Execute certification by signature of authorized officer
 3. Use data from approved *Schedule of Values*. Provide dollar value in each column for each line item for portion of Work performed and for stored products.
 4. List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original Item of Work.
 5. Prepare Application for Final Payment as specified in Section 01700 entitled *Contract Closeout*.
- C. **Submittal Procedures:** (#1 modified Dec 2013 SoS and Jan 2015)
1. Submit original and one (1) copy of each Application for Payment (see also 700.22)
 2. Submit an updated construction schedule with each Application for Payment as described in Section 01310 entitled *Progress Schedule of Values* or Section 01311 entitled *Network Analysis Schedules*.
 3. Submit requests for payment at intervals agreed upon by the Professional, Owner and Contractor.
 4. Submit requests to the Professional at agreed upon times, or as may be directed otherwise.
- D. **Substantiating Data:**
1. Submit data justifying dollar amounts in question when such information is needed.
 2. Provide one (1) copy of the data with a cover letter for each submittal.
 3. Indicate the Application number, date and line item number and description.

CHANGE ORDER PROCEDURES

SECTION 01028

1.01 SCOPE

- A. This Section describes the procedures for processing Change Orders by the Professional and the Contractor.

1.02 CHANGE ORDER PROCEDURES

- A. **Change Proposed by Professional:** The Professional may issue a Proposal Request to the Contractor which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications and a change in Contract Time for executing the change. The Contractor will prepare and submit an estimate within ten (10) days.
- B. **Change Proposed by Contractor:** The Contractor may propose a change by submitting a request for change to the Professional, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other Contractors. Document any requested substitutions in accordance with Section 01630 entitled *Substitutions and Product Options*.
- C. **Contractor's Documentation:**
1. Maintain detailed records of Work completed on a time and material basis. Provide full information required for evaluation of proposed changes, and substantiate costs of changes in the Work.
 2. Document each quotation for a change in cost or time with sufficient data allowing evaluation of the quotation.
 3. On request, provide additional data to support computations:
 - a. Quantities of products, labor, and equipment
 - b. Taxes, insurance and bonds
 - c. Overhead and profit
 - d. Justification for any change in Contract Time
 - e. Credit for deletions from Contract, similarly documented
 4. Support each claim for additional costs, and for Work completed on a time and material basis, with additional information:
 - a. Origin and date of claim
 - b. Dates and times work was performed and by whom
 - c. Time records and wage rates paid
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
- D. **Construction Change Directive:** The Professional may issue a document, approved by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. The document will describe changes in the Work, and will designate method of determining any change in Contract Sum or Contract Time. The change in Work will be promptly executed.
- E. **Format:** The Professional will prepare five (5) originals of the Change Order using the Bureau of Building, Grounds and Real Property Management's *Change Order Form*. (see also 700.20)
- F. **Types of Change Orders:**
1. **Stipulated Sum Change Order:** Based on Proposal Request and Contractor's fixed price quotation, or Contractor's request for a Change Order as approved by the Professional.
 2. **Unit Price Change Order:** For pre-determined unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of work which are not pre-determined, execute Work under a Construction Change Directive. Changes in Contract Sum or Contract Time will be computed as specified for Time and Material Change Order.

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3. **Time and Material Change Order:** Submit itemized account and supporting data after completion of change, within time limits indicated in the *Standard Form of Agreement Between the Owner and the Contractor*. The Professional will determine the change allowable in Contract Sum and Contract Time as provided in the Contract Documents. The Contractor shall maintain detailed records of Work accomplished on Time and Material basis and shall provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.
- G. **Execution of Change Order:** The Professional will issue Change Orders for signatures of parties as provided in the *Standard Form of Agreement Between the Owner and the Contractor*. Final execution of all Change Orders requires approval by the Owner.
- H. **Correlation of Contractor Submittals:** The Contract shall promptly revise *Schedule of Values* and the *Application for Payment* forms to record each authorized Change Order as a separate line item and adjust the Contract Sum. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust time for other items of Work affected by the change and resubmit. Promptly enter changes in Project Record Documents.

ALTERNATES

SECTION 01030

1.01 **DESCRIPTION**

- A. **Scope:** This section describes the changes to be made under each alternate.
- B. **General:** The referenced Specification sections contain the pertinent requirements for materials and methods to achieve the work described herein. Coordinate related work and modify surrounding work, as required, to complete the Project under each alternate designated in the Contract.

1.02 **DESCRIPTION OF ALTERNATES**

- A. Refer to Section 01900 entitled *Division One Supplement* for Project specific description of project Alternates.

PROJECT COORDINATION

SECTION 01041

1.01 **DESCRIPTION**

- A. **Scope:** To set forth procedures, conditions and responsibility for coordination of the total project.
- B. **Project Coordinator:** The General Contractor will designate one (1) individual as Project Coordinator or Superintendent, as referred to in the General Conditions. Prior to beginning the Work, the name and qualifications will be submitted, in writing, to the Professional. Upon the approval of the Professional and the Owner, the Project Coordinator will remain until the Project is completed and cannot be removed during construction without the written consent of the Owner and the Professional.

1.02 **DUTIES OF PROJECT COORDINATOR**

- A. **General:**
1. **Coordination:** Coordinate the work of all Subcontractors and Material Suppliers.
 2. **Supervision:** Supervise the activities of every phase of work taking place on the Project.
 3. **Mechanical/Electrical:** Take special care to coordinate and supervise the work of the plumbing, heating and cooling and electrical Subcontractors.
 4. **Communication:** Establish lines of authority and communication at the job site.
 5. **Location:** The Project Coordinator must be present on the job all of the time.
 6. **Permits:** Assist in obtaining building and special permits required for construction.

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- B. **Interpretations of Contract Documents:**
 - 1. **Consultation:** Consult with Architects and Engineers to obtain interpretations.
 - 2. **Assistance:** Assist in resolution of any questions.
 - 3. **Transmission:** Transmit written interpretations to concerned parties.

 - C. **Cessation of Work:** Stop all work not in accordance with the requirements of the Contract Documents.

 - D. **Division One:** Coordinate and assist in the preparation of all requirements of Division One and specifically as follows:
 - 1. **Cutting and Patching:** Supervise and control all cutting and patching of other trades' work.
 - 2. **Project Meetings:** Schedule and preside at all project meetings.
 - 3. **Construction Schedules:** Prepare and submit all construction schedules; supervise work to monitor compliance with schedules.
 - 4. **Shop Drawings, Product Data and Samples:** Administer the processing of all submittals required by the Project Manual.
 - 5. **Schedule of Values:** Assist in preparation and be knowledgeable of each entry in the Schedule of Values.
 - 6. **Testing:** Coordinate all required testing.
 - 7. **Temporary Facilities and Controls:** Allocate, maintain and monitor all temporary facilities.
 - 8. **Substitutions and Product Options:** Administer the processing of all substitutions.
 - 9. **Project Closeout:** Conduct final inspections and assist in collection and preparation of closeout documents.
 - 10. **Cleaning:** Direct and execute a continuing cleaning program throughout construction, requiring each trade to dispose their own debris.
 - 11. **Project Record Documents:** Maintain up-to-date project record documents.
 - 12. **Safety Measures:** Plan and enforce all safety requirements.

 - E. **Changes:** Recommend and assist in the preparation of requests to the Professional for any changes in the Contract.

 - F. **Application for Payment:** Assist in the preparation and be knowledgeable of each entry in the Application and Certificate for Payment.

1.03 **SUBCONTRACTOR'S DUTIES**

- A. **General:** The Subcontractor is responsible for coordinating and supervising employees in the work to be accomplished under their part of the Contract.

- B. **Schedules:** Conduct work to assure compliance with construction schedules.

- C. **Suppliers:** Transmit all instructions to Material Suppliers.

- D. **Cooperation:** Cooperate with the Project Coordinator and other Subcontractors.

1.04 **OWNER-PURCHASED PRODUCTS**

- A. **General:** Cooperate, accept delivery, arrange storage and protect Owner-purchased products until installation, or final acceptance.

CUTTING AND PATCHING

SECTION 01045

1.01 GENERAL DESCRIPTION

- A. **Scope:** To set forth broad, general conditions covering cutting and patching that applies to everyone and everything on the job.
- B. Execute cutting including excavating, fitting, or patching of work required to:
 - 1. Make several parts fit properly.
 - 2. Uncover work to provide for installation of ill-timed work.
 - 3. Remove and replace defective work.
 - 4. Remove and replace work not conforming to Contract requirements.
 - 5. Install specified work in existing construction.
- C. In addition to Contract requirements, upon Professional's written instructions:
 - 1. Uncover work for observation of covered work.
 - 2. Remove samples of installed materials for testing.
 - 3. Remove work to provide alteration of existing work.
- D. Do not cut or alter work of another Contractor without permission.
- E. **Payment of Costs:** Costs caused by ill-timed, or defective work, or work not conforming to Contract Documents will be borne by party responsible for ill-timed, defective work, or non-conforming work.

1.02 MATERIALS/PRODUCTS

- A. **Materials for Replacement or Work Removed:** Comply with Specifications for type of work to be accomplished.

1.03 EXECUTION

- A. **Inspection:** Inspect existing conditions of work, including elements subject to movement, or damage during cutting and patching.
- B. **Preparation Prior to Cutting:** Provide shoring, bracing and support, as required, to maintain structural integrity of the building. Provide protection for other portions of work and protection from the elements.
- C. **Performance:**
 - 1. Execute cutting and demolition by methods which prevent damage to other work and will provide surfaces to receive installation of repairs and new work.
 - 2. Execute excavating and backfilling by methods which prevent damage to other work and prevent settlement.
 - 3. Restore work which has been cut or removed; install new products to provide completed work in accordance with requirements of Contract Documents.
 - 4. Refinish entire surfaces, as necessary, to provide an even finish. Refinish continuous surfaces to the nearest intersection and assemblies entirely.

PROJECT MEETINGS

SECTION 01200

1.01 DESCRIPTION

- A. **Contractor's Responsibilities:** The General Contractor will administer all progress meetings which include the following:
1. Prepare agenda
 2. Distribute written notice of meetings seven (7) days in advance
 3. Make physical arrangements for and presiding at the meetings
 4. Record minutes
 5. Distribute copies of the minutes to participants within four (4) days
- B. **Pre-Construction Meeting:** The Bureau will schedule a pre-construction meeting as soon as possible after the award of Contract and the issuance of a *Notice to Proceed*.
1. **Attendance:**
 - a. Owner
 - b. Professional and Consultants
 - c. General Contractor
 - d. Major Subcontractors, including mechanical and electrical
 - e. Representatives of governmental, or other regulatory agencies
 - f. Commissioning Authority Professional (if Cx on project)
 2. **Minimum Agenda:** (prepared by the General Contractor)
 - a. Distribute and discuss list of major Subcontractors and construction schedule
 - b. Critical work sequencing
 - c. Designation of responsible personnel
 - d. Procedures for maintaining record documents
 - e. Use of premises, including office and storage areas
 - f. Owner's requirements
 - g. Security procedures
 - h. Housekeeping procedures
 - i. Commissioning issues (if Cx on project)
 3. **Utilities:** A written agreement must be reached on how all utilities will be furnished and the rates the Contractor will be charged. This agreement should be resolved at this meeting. Refer to Section 1500 entitled *Construction Facilities and Temporary Controls* of this Project Manual for additional utility requirements.
- C. **Progress Meetings:**
1. The Bureau will schedule regular meetings at the time of the pre-construction conference
 2. Hold all meetings as progress of work dictates
 3. **Attendance:**
 - a. Owner
 - b. Professional and Consultants
 - c. General Contractor
 - d. Subcontractors, as pertinent to the agenda
 - e. Commissioning Authority Professional (if Cx on project)
 4. **Minimum Agenda:**
 - a. Review, approve minutes of the previous meeting
 - b. Review work progress since last meeting
 - c. Note field inspections, problems and decisions
 - d. Identify problems which impede planned progress
 - e. Review off-site fabrication problems
 - f. Revise construction schedule, as indicated
 - g. Plan progress during the next work period
 - h. Review proposed changes
 - i. Complete other current business

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- j. Commissioning issues (if Cx on project)
- D. Commissioning Meetings: (if Cx on project) The Bureau will schedule a commissioning scoping meeting at the pre-construction conference. Regular Commissioning Meetings will coincide with regularly scheduled Progress Meetings until such time that the Commissioning Process requires additional meetings. The Commissioning Authority Professional will chair, facilitate and document Commissioning Meetings.
- 1. Attendance:
 - a. Owner
 - b. Commissioning Authority Professional
 - c. Professional and Consultants
 - d. General Contractor
 - e. Subcontractors, as pertinent to unresolved issues identified in current Issues Log
 - f. Testing, Adjusting and Balancing Contractor
 - g. Using Agency's Building Operator/Physical Plant Representative
 - 2. Minimum Agenda:
 - a. Review, approve minutes of the previous meeting
 - b. Review Issues Log

PROGRESS SCHEDULES

SECTION 01310

1.01 DESCRIPTION

- A. **Scope:** Provide projected construction schedules for entire work and revise periodically. The following is a minimum requirement and other type schedules are acceptable with Owner's approval. This type of schedule is acceptable for any Project whose initial Contract award amount if **less than** one (1) million dollars (\$1,000,000).
- B. **Form of Schedules:** Prepare in form of horizontal bar chart.
- 1. Provide separate horizontal bar column for each trade or operation.
 - 2. Place in order of the Table of Contents of Specifications.
 - 3. Identify each column by major Specification section number.
 - 4. Identify the first work day of each week by horizontal time scale.
 - 5. Scale and space to allow for updating.
- C. **Contents of Schedule:**
- 1. Provide complete sequence of construction by activity.
 - 2. Indicate dates for beginning and completion of each stage of construction.
 - 3. Identify work of separate floors, separate phases, or other logically grouped activities.
 - 4. Show projected percentage of completion for each item of work as of first day of month.
- D. **Updating:**
- 1. Show all changes occurring since previous submission of updated schedule.
 - 2. Indicate progress of each activity and completion dates.
- E. **Submittals:**
- 1. Submit initial schedules to the Professional within fifteen (15) days after date of Notice to Proceed.
 - 2. Submit to Professional periodically updated schedules accurately depicting progress to first day of each month.
 - 3. Submit two (2) copies, one (1) to be retained by the Professional and the other forwarded to the Owner.

NETWORK ANALYSIS SCHEDULE

SECTION 01311

1.01 DESCRIPTION

- A. **Scope:** Provide projected network analysis schedules for the entire Work and revise periodically. This type of schedule is acceptable for any Project whose initial Contract award amount is one million dollars (\$1,000,000), **or greater**.

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1.02 **REFERENCES**

- A. **CPM in Construction:** The latest edition of the Manual entitled **The Use of CPM in Construction, A Manual for General Contractors and the Construction Industry**, published by the Associated General Contractors of America (AGC) - Washington, D.C. shall be used.

1.03 **QUALITY ASSURANCE**

- A. **Contractor's Administrative Personnel:** Two (2) years minimum experience in using and monitoring CPM schedules on comparable Projects is required.

1.04 **FORMAT**

- A. **Listings:** Reading from left to right, in ascending order for each activity, identify each activity with the applicable specification section number.
- B. **Diagram Sheet Size:** Height and width as required.
- C. **Scale and Spacing:** To allow for notations and revisions.

1.05 **SCHEDULES**

- A. **Critical Path Methods:** Prepare network analysis diagrams and supporting mathematical analyses using the *Critical Path Method* under *Concepts and Methods* as outlined in the AGC's **The Use of CPM in Construction, A Manual for General Contractors and the Construction Industry**.
- B. **Order of Work:** Illustrate order and interdependence of activities and sequence of Work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.
- C. **Complete Sequence of Construction:** Illustrate complete sequence of construction by activity, identifying work of separate stages. Provide dates for submittals and return of submittals; dates for procurement and delivery of products; and dates for installation and provision for testing. Provide legend for symbols and abbreviations used.
- D. **Mathematical Analysis:** Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
1. Preceding and following event numbers
 2. Activity description
 3. Estimated duration of activity, in maximum thirty (30) day intervals
 4. Earliest start date
 5. Earliest finish date
 6. Actual start date
 7. Actual finish date
 8. Latest start date
 9. Latest finish date
 10. Total and free float
 11. Monetary value of activity (keyed to *Schedule of Values*)
 12. Percentage of activity completed
 13. Responsibility
- E. **Analysis Program:** Capable of compiling monetary value of completed and partially completed activities, of accepting revised completion dates, and recomputation of all dates and floats.
- F. **Required Sorts:** List activities in sorts or groups:
1. By preceding work item or event number from lowest to highest

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2. By amount of float, then in order of early start
 3. By responsibility in order of earliest possible start date
 4. In order of latest allowable start dates
 5. In order of latest allowable finish dates
 6. Contractor's periodic payment request sorted by *Schedule of Values* listings, Specifications section
 7. Listing of basic input data which generates the report
 8. Listing of activities on the critical path
 9. Monthly cash flow

G. **Schedule of Values:** Coordinate contents with *Schedule of Values* in Section 01300.

1.06 SUBMITTALS FOR REVIEW

- A. **Preliminary Network Diagram:** Within fifteen (15) days after the date established in the *Notice to Proceed* submit proposed preliminary network diagram defining planned operations for the first sixty (60) days of Work, with a general outline for the remaining Work.
- B. **Review:** Participate in review of preliminary and complete network diagrams jointly with the Professional.
- C. **Proposed Complete Network Diagram:** Within twenty (20) days after joint review of proposed preliminary network diagram, submit draft of proposed complete network diagram for review. Include written certification that mechanical and electrical Subcontractors have reviewed and accepted proposed schedule.
- D. **Complete Network Diagram:** Within ten (10) days after joint review, submit complete network analysis consisting of network diagrams and mathematical analysis.
- E. **Updated Network Schedules:** Submit updated network schedules with each Application for Payment.
- F. **Copies:** Submit the number of opaque reproductions the Contractor requires, plus two (2) copies which will be retained by the Professional and the Owner.

1.07 REVIEW AND EVALUATION

- A. **Review:** Participate in joint review and evaluation of network diagrams and analysis with the Professional at each submittal.
- B. **Evaluate:** Evaluate Project status to determine Work behind schedule and Work ahead of schedule.
- C. **Revisions:** After review and approval of the Professional, revise as necessary as a result of the review and resubmit within ten (10) days.

1.08 UPDATING SCHEDULES

- A. **Schedules:** Maintain schedules to record actual start and finish dates of completed activities.
- B. **Progress:** Indicate progress of each activity to date of revision, with projected completion date of each activity. Update diagrams to graphically depict current status of Work.
- C. **Modifications:** Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- D. **Changes:** Indicate changes required to maintain Date of Substantial or Total Completion. These changes will be made only with the approval of the Professional.

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- E. **Extensions:** Contract completion time will be adjusted only for causes specified in the Contract. Requests for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the Owner may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the Contract. Submission of proof based on revised activity logic duration and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in the request. The Owner's determination as to the total number of days of contract extension shall be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information. Actual delays in activities which, according to the computer-produced calendar-dated schedule, do not affect the extended and predicted contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The Owner will, within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Owner's decision. The Contractor shall submit each request for a change in the contract completion date to the Owner. The Contractor shall include as a part of each change order proposal, a sketch showing all CPM revisions, duration changes, and cost changes, for the work in question and its relationship to other activities on the approved arrow diagram.
- F. **Substantiate:** Submit sorts required to support recommended changes.
- G. **Report:** Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

1.09

DISTRIBUTION

- A. **Distribution of Copies:** Following joint review, distribute copies of updated schedules to Contractor's Project site, to Subcontractors, Suppliers, Professional and Owner.
- B. **Reporting Problems:** Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

SECTION 01340

1.01

DESCRIPTION

- A. **Scope:** Submit to the Professional shop drawings, product data and samples required by Specification sections. Submit an additional copy of shop drawings, product data and samples related to items/systems identified to be commissioned to the Commissioning Authority Professional to be reviewed concurrently with the Professional. (if Cx on project).
- B. **Shop Drawings:** Original drawings prepared by Contractor, Subcontractor, Supplier, or Distributor which illustrate some portion of the Work; showing fabrication, layout, setting, or erection details.
1. Prepared by a qualified detailer.
 2. Identify details by reference to sheet and detail numbers shown on Contract drawings.
 3. Minimum sheet size: 8 1/2" x 11"
 4. Reproductions for submittals: Opaque diazo prints.
- C. **Product Data:**
1. **Manufacturer's Standard Schematic Drawings:** Modify drawings to delete information which is not applicable to the Project. Supplement standard information to provide additional information applicable to the Project.
 2. **Manufacturer's Catalog Sheets, Brochures, Diagrams, Schedules, Performance Charts, Illustrations and Other Standard Descriptive Data:** Clearly mark each copy to identify pertinent materials, products, or models. Show dimensions and clearances required. Show performance characteristics and capacities, wiring diagrams and controls.

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- D. **Samples:** Physical examples to illustrate materials, equipment or workmanship and to establish standard by which completed work is judged.
1. **Office Samples:** Of sufficient size and quantity to clearly illustrate functional characteristics of products or material with integrally related parts and attachment devices and full range of color samples. After review, samples remain the property of the Professional until completion of the construction project.
 2. **Field Samples and Mock-ups:** Erect on project site at location acceptable to Professional. Construct each sample, or mock-up, completely including work of all trades required in finished work.
- E. **Contractor's Responsibilities:**
1. Review shop drawings, product data and samples prior to submission.
 2. Verify field measurements, field construction criteria, catalog numbers and similar data.
 3. Coordinate each submittal with requirements of work and of Contract Documents.
 4. Contractor's responsibility for errors and omissions in submittals is not relieved by the Professional's review of submittals.
 5. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Professional's review of submittals unless Professional gives written acceptance of specific deviations.
 6. Notify Professional in writing at the time of submission of deviations in submittals from requirements of Contract Documents.
 7. Begin no work requiring submittals until the return of submittals bearing Professional's stamp and initials, or signature indicating review.
 8. After Professional's review, distribute copies.
- F. **Submission Requirements:**
1. Schedule submission with ample time before dates reviewed submittals will be needed.
 2. Submit number of copies of shop drawings and product data which Contractor requires for distribution, plus one (1) copy to be retained by the Professional.
 3. Submit number of samples specified in each Specification section.
 4. Accompany submittals with transmittal letter, in duplicate, containing date, Project title and number; Contractor's name and address; the number of each shop drawings, product data and samples submitted; notification of deviations from Contract Documents; and, other pertinent data.
 5. Submittals shall include:
 - a. Date and revision dates.
 - b. Project title and number.
 - c. The names of the Professional, Contractor, Supplier, Manufacturer and separate detailer, when pertinent.
 - d. Identification of product, or material.
 - e. Relation to adjacent structure, or materials.
 - f. Field dimensions clearly identified as such.
 - g. Specification section number.
 - h. Applicable standards such as ASTM number, or federal specifications.
 - i. A blank space (2" x 3") for the Professional's stamp.
 - j. Identification of deviations from Contract Documents.
 - k. Contractor's stamp, initialed or signed, certifying the review of submittal, verification of field measurements and compliance with Contract Documents.
- G. **Resubmission Requirements:**
1. **Shop Drawings:** Revise initial drawings, as required, and resubmit as specified for initial submittal. Indicate on the drawings any changes which have been made other than those required by the Professional.
 2. **Product Data and Samples:** Submit new data and samples, as required, for initial submittal.

H. **Distribution of Submittals After Review:**

1. Distribute copies of shop drawings and product data which carry Professional's stamp to Contractor's file, job site file, Subcontractor, Supplier and Fabricator.
2. Distribute samples as directed.

I. **Professional's Duties:**

1. Review submittals with reasonable promptness.
2. Review for design concept of Project and information given in Contract Documents.
3. Review of separate item does not constitute review of an assembly in which item functions.
4. Affix stamp and initials, or signature, certifying the review of submittal.
5. Return submittals to Contractor for distribution.

TESTING LABORATORY SERVICES

SECTION 01410

1.01 **DESCRIPTION**

- A. **Scope:** The Contractor will employ and pay for the services of an independent laboratory to perform specified services. Employment of a testing laboratory shall in no way relieve the Contractor of his obligation to perform work in accordance with the Contract.
- B. **Inspection, Sampling and Testing:** Refer to each individual specification section for specific inspection, sampling and testing requirements.
- C. **Qualification of Laboratory:**
1. Meet the *Recommended Requirements for Independent Laboratory Qualification* published by the American Council of Independent Laboratories.
 2. Meet the basic requirements of ASTM E 329-70, *Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction*.
 3. **Responsible Engineer:** Perform all testing under the direct supervision of a registered Professional engineer employed full time by the testing laboratory.
 4. **Submittals:** Submit a copy of the inspection report of the facilities made by materials reference laboratory of National Bureau of Standards of any deficiencies reported by the inspection.
 5. **Approval:** The Professional must approve the testing laboratory.
- D. **Laboratory's Duties:**
1. Upon notice, cooperate with the Professional and the Contractor to promptly provide qualified personnel. Perform specified inspections, sampling and testing of materials and methods of construction to ascertain compliance with requirements of Contract Documents. Promptly notify the Professional and the Contractor of irregularities or deficiencies of work observed during performance of services.
 2. Reports of inspections and tests will include:
 - a. Date issued
 - b. Project title and number
 - c. Testing laboratory's name and address
 - d. Name and signature of inspector
 - e. Date of inspection, or sampling
 - f. Record of temperature and weather
 - g. Date of test
 - h. Identification of product and Specification section
 - i. Location of Project
 - j. Type of inspection, or test
 - k. Observations regarding compliance with Contract Documents

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3. Prompt distribution of copies of the inspection reports and tests to:
 - a. Owner
 - b. Professional
 - c. General Contractor
 - d. Consulting Engineer, when pertinent
 - e. Subcontractor, when pertinent
- E. **Contractor's Responsibilities:**
1. Cooperate with laboratory personnel to provide access to work and to manufacturer's operation. Provide the laboratory with the required quantities of preliminary samples representative of materials to be tested and required quantities. When required, furnish copies of mill test reports. Furnish laboratory casual labor to obtain and handle samples at the site and to facilitate inspections and tests. Provide facilities for laboratory's exclusive use for storage and curing of test samples. Notify laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.
 2. Arrange and pay for additional samples and tests required for Contractor's convenience. When initial tests indicate work does not comply with Contract Documents, the Contractor may employ and pay for the services of a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing.

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

SECTION 01500

1.01 DESCRIPTION

- A. **Scope:** Work required under this section consists of all temporary construction facilities, services and related items to complete the work indicated on the drawings and described in the Project Manual.
- B. **Standards:**
1. Conform to or exceed all temporary construction requirements stated in the current edition of the **Standard Building Code** [Chapter entitled *Safeguards During Construction*].
 2. Refer to Article 10.1.1 in Section 00700 entitled *General Conditions*.
- C. **Materials:** All materials required by the Work of this section shall be as specified in the respective sections.

1.02 FACILITIES AND CONTROLS

- A. **Access:** The Prime General Contractor shall provide an adequate access and/or roads to the site of the structure, if required for the prosecution of work; and, should also provide and maintain at least one (1) temporary, or permanent, access to each working elevation to be permanently occupied.
- B. **Hoisting Facilities:** The Prime General Contractor shall be responsible for providing suitable capacity and hoisting facilities for all people and materials. The use of the hoisting facilities shall be by mutual agreement of the Prime General Contractor and the individual Contractor.
- C. **Field Office and Sheds:** At all times, the Prime General Contractor shall provide and maintain a weatherproof office with telephone, which may also be used by Subcontractors, the Owner and the Professional. Office location will be approved by the Owner. Each general and individual Contractor shall provide suitable watertight/dampproof sheds to house their construction materials.
- D. **Sanitation Facilities:** The Prime General Contractor is responsible for furnishing adequate temporary toilet facilities on the job site.
- E. **Drinking Water:** The Prime General Contractor shall provide at all times sanitary drinking water facilities for all workmen on the job including ice, when required, and paper cups, etc..

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- F. **Fire Protection:** The Prime General Contractor shall provide general temporary fire protection. Subcontractors will be responsible for their own.
 - G. **Storage:** The Prime General Contractor shall coordinate the allocation of storage areas to the various Subcontractors.
 - H. **Temporary Heat:** The Prime General Contractor shall provide heat, fuel and services, as necessary, to protect all work from dampness and cold until final acceptance. If in the late stages of the construction, mechanical and electrical installations will permit, the mechanical and electrical facilities may be used to provide heat and ventilation. However, the Owner is saved harmless of any costs of operation or responsibility as to acceptance of mechanical and/or electrical installations.
 - I. **Utilities:** The Prime General Contractor shall make arrangements for and furnish all water, electricity (lighting and power) and other utilities necessary for construction purposes. A written agreement must be reached on how all utilities (water and electricity) will be furnished and the rates the Contractor will be charged. A copy of the final agreement signed by the Contractor and the Institution or Agency must be forwarded to the Owner. If the written agreement is not filed with the Owner, the Contractor and the Institution or Agency waives all rights as to the rates charged. The Owner will then determine all utility rates and assess the charges before final payment is rendered.
 - J. **Project Sign:** (see also 600.31) (see 700.19; Exhibit B in Div 1 01900) (new State Seal per Legislature July 1, 2014)
 - 1. The Prime General Contractor will erect on adequate supports and maintain one (1) neatly constructed and painted 3/4" thick plywood sign of size, color, layout, and location as indicated in the Contract Documents. (example attached as Exhibit "B" at the end of Division 1 Section 01900)
 - 2. No other signs will be displayed on the job site without permission of the Professional. The displaying of sign advertisements is strictly prohibited.

SUBSTITUTIONS AND PRODUCT OPTIONS

SECTION 01630

(01630 Revised August 2016;
see Inst to Bidders 2.05)

1.01 DESCRIPTION

- A. Scope: To set forth the procedure and conditions for substitutions and to give the product options available to the Contractor.

1.02 PRODUCTS LIST

- A. Within thirty (30) days after the Contract has been signed, the Contractor will submit to the Professional five (5) copies of a complete list of all products proposed for installation.
- B. Tabulate the list by Specification sections.
- C. For products specified under reference standards, include with listing of each product:
 - 1. Name and address of Manufacturer.
 - 2. Trade name.
 - 3. Model, or catalog designation.
 - 4. Manufacturer's data.
 - 5. Performance and test data.
 - 6. Reference standards.

1.03 CONTRACTOR'S OPTIONS

- A. For products specified only by reference standards or technical performance requirements, select any product meeting product standards by any Manufacturer.

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- B. For products specified by naming a minimum of three (3) products or Manufacturers, select any product and Manufacturer named. Equivalent products will always be accepted if equal in all consequential respects.
 - C. For product specified by naming one (1) or more products and/or Manufacturers, but indicating the option of selecting equivalent products by stating "or equal" after specified product and/or Manufacturer, select any product meeting specified reference standards or technical performance requirements as represented by the named products and/or Manufacturers.
 - D. For products specified by naming only one (1) product and/or Manufacturer as a "basis of design", an equivalent product will always be accepted if it is equal in all consequential respects.
 - E. For products specified by naming only one (1) product and Manufacturer and stating no substitutions will be accepted, there is no option and no substitutions will be allowed. This option must have written approval by the Owner before bidding.

1.04 SUBSTITUTIONS

- A. A product or construction method that varies from a product or construction method specified in one or more consequential characteristics, reference standards, or technical performance requirements shall be considered a substitution.
- B. Professional will not consider requests for substitutions during bidding.
- C. Within thirty (30) days after the Contract has been signed, the Professional will consider formal requests from the Contractor for substitution of products in place of those specified. Submit five (5) copies of the request for substitutions. Include in the request:
 - 1. Narrative summarizing characteristics, reference standards, or technical performance requirements that product varies from and how the proposed product or construction method will meet or exceed project requirements
 - 2. For products:
 - a. Product identification including Manufacturer's name and address.
 - b. Manufacturer's literature: Product description, performance and test data and reference standards.
 - c. Samples.
 - d. Name and address of similar projects on which product was used and date of installation.
 - 3. For construction methods:
 - a. Detailed description of proposed method.
 - b. Drawings illustrating methods.
 - 4. Agreement to pay for any additional professional costs if acceptance of substitution will require substantial revision of Contract Documents.
 - 5. Data relating to any delays to the construction schedule if any will result from proposed substitution.
 - 6. Accurate cost data on proposed substitution if any project cost increases are anticipated or any cost savings are being offered for proposed substitution.
- D. In making request for substitution, Contractor represents:
 - 1. Proposed product, or method, has been investigated and determined that it is equal or superior in all respects to that specified.
 - 2. The same or better guarantee and/or warranty will be provided for substitutions for product or method specified.
 - 3. Installation of accepted substitutions will be coordinated into the Work, making such changes required of work to be complete in all respects at no additional cost to the Owner.
 - 4. All claims for additional costs related to substitution, including any delays to the construction schedule, which consequently become apparent will be waived.
 - 5. Unless specifically identified in substitution submittal and such delay is specifically agreed to by Change Order to the Contract, substitution will not cause any delay to the construction schedule.
 - 6. Proposed product, or method, will not result in any additional costs to the Owner.
- E. Substitutions will not be considered if:
 - 1. Indicated, or implied, on shop drawings or product data submittals without formal request submitted in accordance with this Section.

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2. Acceptance will require substantial revision of Contract Documents unless compensation for such additional professional costs are paid by Contractor at no additional cost to the Owner.
 3. In the Professional's judgment, the product, or material, is not equal.

STARTING OF SYSTEMS

SECTION 01650

1.01 GENERAL

- A. **Scope:** This Section describes the procedures for start up of all building equipment and systems including necessary demonstration and instructions.

1.02 STARTING SYSTEMS

- A. Coordinate Schedule for start-up of various equipment and systems.
- B. Notify Professional and Owner seven (7) days prior to start-up of each system.
- C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.
- D. Verify that tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of responsible Contractors' personnel in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require Manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

1.03 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Owner's personnel prior to date of Substantial Completion.
- B. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at designated location.
- D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

CONTRACT CLOSEOUT

SECTION 01700

1.01 DESCRIPTION

- A. **Scope:** The work required in this Section consists of the final inspections and the submission of all closeout documents and related items to complete the Work indicated on the Drawings and described in the Project Manual.

FINAL INSPECTIONS

- A. **Professional's Inspection:** The Contractor shall make written request for a final inspection to the Professional; notice to be given ten (10) days prior to the inspection. A list of any deficiencies, compiled by the Professional, will be corrected by the Contractor. If, in the Professional's judgement, the Project is not ready for a final inspection, the Professional may schedule another inspection
- B. **Owner's Inspection:** After the Professional has ascertained the Project to be ready, an Owner's inspection will be scheduled within ten (10) days thereafter. The Contractor will have ten (10) days after the Owner's acceptance to make any corrections of punch list items and to submit closeout documents.
- C. **Correction of Work Before Final Payment:** The Contractor shall promptly remove from the Owner's premises all materials condemned for failure to conform to the Contract, whether incorporated in the Work or not, and the Contractor shall, at his own expense, replace such condemned materials with those conforming to the requirements of the Contract. Failure to remedy such defects after ten (10) days written notice will allow the Owner to make good such defects and such costs shall be deducted from the balance due the Contractor, or charged to the Contractor in the event no payment is due.

CLOSEOUT DOCUMENTS

Unless otherwise notified, the Contractor shall submit to the Owner through the Professional, three (3) copies of the following before final payment is made:

- A. **Request for Final Payment:** AIA Document G702, current edition, completed in full or a computer generated form having similar data.
- B. **Consent of Surety Company to Final Payment:** AIA Document G707, current edition, completed in full by the Bonding company.
- C. **Power of Attorney:** Closeout documents should be accompanied by an appropriate Power of Attorney.
- D. **Release of Liens and Certification that All Bills Have Been Paid:** AIA Document G706A, current edition, completed in full or a sworn statement and affidavit from the Contractor to the Owner stating that all bills for this job have been paid and that the Owner is released from any and all claims and/or damages.
- E. **Contractor's Affidavit of Payment of Debts and Claims:** AIA Document G706, current edition, completed in full.
- F. **Guarantee of Work:** Sworn statement that all work is guaranteed against defects in materials and workmanship for one (1) year from date of Owner's acceptance, except where specified for longer periods.
 1. Word the Guarantee as follows, or in a similar manner:
We hereby guarantee all work performed by us on the above captioned Project to be free from defective materials and workmanship for a period of one (1) year or such longer period of time as may be called for in the Contract Documents for such portions of the Work.
 2. All guarantees and warranties shall be obtained in the Owner's name.
 3. Within the Guaranty period, if repairs or changes are requested in connection with guaranteed work which, in the opinion of the Owner, are rendered necessary as a result of the use of materials, equipment or workmanship which are inferior, defective or not in accordance with the terms of the Contract, the Contractor shall promptly, upon receipt of notice from and without expense to the Owner, place in satisfactory condition building, site, equipment or contents thereof. The Contractor shall make good any work, materials, equipment or contents of said buildings or site which may be disturbed by fulfilling any such Guaranty.
 4. If, after notice, the Contractor fails to proceed promptly to comply with the terms of the Guaranty, the Owner may have the defects corrected and the Contractor and his Sureties shall be liable for all expense incurred.
 5. All special guarantees applicable to definite parts of the work stipulated in the Project Manual or other documents forming part of the Contract shall be subject to the terms of this paragraph during the first year of the life of such special guaranty.

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- G. **Project Record Document:** Furnish all other record documents as set forth in Section 01720 entitled *Project Record Documents*.
 - H. **Additional Documents Specified Within the Project Manual:** Provide all additional certificates, warranties, guarantees, bonds or documents as called for in the individual sections of the Project Manual. The Contractor is responsible for examining the Project Manual for these requirements.

CLEANING SECTION 01710

1.01 DESCRIPTION

- A. **Scope:** Maintain premises and public properties from accumulations of waste, debris and rubbish caused by operations. At completion of work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials and clean all sight-exposed surfaces; leave Project clean and ready for occupancy.

1.02 PRODUCTS

- A. **Materials:** Use only cleaning materials recommended by Manufacturer of surface to be cleaned. Use cleaning materials only on surfaces recommended by the cleaning materials Manufacturer.

1.03 EXECUTION

- A. **During Construction:** Execute cleaning to insure that building, grounds and public properties are maintained free from accumulations of waste materials and rubbish. Wet down dry materials and rubbish to lay dust and prevent blowing dust. At reasonable intervals during progress of work, clean site and public properties and dispose of waste materials, debris and rubbish. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off Owner's property. Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for substantial completion or occupancy. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights. Schedule cleaning operations so that dust or other contaminants resulting from cleaning process will not fall on wet or newly painted surfaces.
- B. **Final Cleaning:** Employ experienced workmen, or professional cleaners, for final cleaning. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces and concealed spaces. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight-exposed finishes. Repair, patch and touch up marred surfaces to specified finish to match adjacent surfaces. Broom clean paved surfaces; rake clean other surfaces of grounds. Replace air conditioning filters, if units were operated during construction. Clean ducts, blowers and coils if air conditioning units were operated without filters during construction. Maintain cleaning until Project, or respective portions thereof, is occupied by Owner.

PROJECT RECORD DOCUMENTS SECTION 01720

1.01 DESCRIPTION

- A. **Scope:** To set forth the procedure and requirements for keeping project record documents.
- B. **Maintenance Documents:** (modified Dec 2013 SoS)
 - 1. Throughout the Contract, maintain one (1) copy of all of the following: Contract Drawings, Project Manual, Addenda, Change Order(s), reviewed shop drawings, reviewed submittals, hardware schedules, field, and laboratory test records, equipment brochures, parts lists, operating instructions and other modifications to the Contract.
 - 2. Store documents on site apart from documents used for construction.

Division One

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3. Maintain documents in clean, dry, legible condition. Do not use record documents for construction purposes.
 4. Make documents available, at all times, for inspection by the Professional, Commissioning Authority Professional, and the Owner.
 5. Keep documents in 8 ½" x 11" loose leaf binders. Clearly label each binder on the spine. Sub-divide with permanently marked tabs of card stock. Provide a main tab for each specification section. Provide sub-tabs for each major piece of equipment or component.
 6. Format for information behind each tabbed piece of equipment/component shall be:
 - a. Contractor/Installer Information: Include address, phone number and contact name. Include emergency service contact information as applicable.
 - b. Manufacturer Information: Include address, phone number and contact name.
 - c. Shop Drawings and Product Data
 - d. Operation and Maintenance Instructions
 - e. Control Drawings

C. **Recording:**

1. **General:** Mark all modifications in red pencil. Keep record documents current. Do not permanently conceal any work until required information has been recorded.
2. **Contract Drawings:** Legibly mark to record actual construction.
 - a. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
 - b. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 - c. Field changes in dimension and detail.
 - d. Changes made by change order(s) or field order(s).
3. **Project Manual and Addenda:** Legibly mark up each section to record Manufacturer, trade name, catalog number and Supplier of each product and item of equipment actually installed.
4. **Shop Drawings:** Maintain as record documents. Legibly mark drawings to record changes made after review.

- D. **Submittal:** At completion of Project, deliver two (2) copies of each record document to the Professional, who will transmit both sets to the Institution or Agency. Additionally, provide to Owner updated As-Built Contract Documents in electronic format utilizing electronic format copy of Contract Documents furnished by Professional or by scanning of marked-up contract Documents. (see also 600.57 and 700.40 regarding electronic As-Built Documents) (modified Dec 2013 SoS)

DIVISION ONE SUPPLEMENT
SECTION 01900

PART 1 - SUMMARY OF WORK SUPPLEMENT

1.01 **WORK SEQUENCE**

- A. Owner will occupy the building during construction, coordinate with Owner's Representative in scheduling work to vacate the areas as the Contractor requires.
- B. Construct work in stages as follows:
 - 1. _____
 - 2. _____
 - 3. _____

1.02 **PARTIAL OWNER OCCUPANCY**

- A. Schedule early completion of designated areas for Owner's usage prior to substantial completion of entire Project.
 - 1. _____
 - 2. _____
 - 3. _____
- B. Owner will occupy areas for purpose of _____
- C. Contractor will provide:
 - 1. Access for Owner's personnel
 - 2. Operation of heating, ventilating, air conditioning and electrical systems
 - 3. _____
- D. Prior to occupancy, execute a *Certificate of Substantial Completion* for designated areas.
- E. Upon occupancy, Owner shall provide:
 - 1. _____
 - 2. _____

PART 2 - ALLOWANCE SUPPLEMENT

2.01 **SCHEDULE OF ALLOWANCES**

- A. Include in the Bid, for inclusion in the Contract Sum, the amount of \$ 191,000.00 for purchase of Energy Management & System Control Allowance
(Refer to Section 15900, Energy Management & Temperature Control System)
- B. Include in the Bid, for inclusion in the Contract Sum, the amount of \$ _____ for purchase of _____
(Refer to Section _____, _____)

Department of Finance and Administration
Bureau of Building, Grounds and Real Property Management
501 NORTH WEST STREET, SUITE 1401 B • JACKSON, MISSISSIPPI 39201
TEL (601) 359-3621 • FAX (601) 359-2470

Minority Tracking or Participation Form
February 2003

This document will serve as a tracking instrument for minority participation in publicly funded construction projects managed by the Bureau of Building, Grounds and Real Property Management. This document will aid DFA/BOB in its commitment to encourage minority participation during the bidding process. Your conscientious effort and commitment to help establish good business relations with minority subcontractors, consultants, suppliers, partners and/or joint ventures is greatly appreciated.

Any responses will be deemed public information and may be incorporated into reporting information compiled by the Bureau of Building in the following manner: Contractors that listed minority participation, Contractors that did not list minority participation and Contractors that submitted an incomplete (partially filled-out or blank) form.

Division One

Section 01010 SUMMARY OF WORK
1.01 Work Covered by Contract Documents
F. Subcontractors List

F.1 The Prime General Contractor will submit to the Owner within seven (7) days from the Notice to Proceed, a completed *Minority Tracking Form* (as follows) outlining the use of minority subcontractors that will be used on the project.

Minority - A person who is a citizen or lawful permanent resident of the United States and who is the following: **African American, Hispanic American, Asian American, American Indian or Female**

Project Name and Number: _____

General Contractor: (Name) _____

Check the Following Appropriate Box

There are NO minority participants included in this bid proposal.

There are minority participants included in this bid proposal. The minority participants may be defined as: Subcontractor(s)/Consultant(s)/ Supplier(s) / Partner(s) / Joint Ventures(s).

List minority participants and their discipline/responsibility per the above or per Construction Specification Institution (CSI) sixteen (16) divisions.

Page 2 of 3
DFA / Bureau of Building
Minority Participation Form

Name: _____

Division: _____

Amount \$ _____

Name: _____

Division: _____

Amount \$ _____

Name: _____

Division: _____

Amount \$ _____

Name: _____

Division: _____

Amount \$ _____

Name: _____

Division: _____

Amount \$ _____

Name: _____

Division: _____

Amount \$ _____

Name: _____

Division: _____

Amount \$ _____

Division One

Page 3 of 3 (Submit if necessary)
DFA / Bureau of Building
Minority Participation Form

Name: _____

Division: _____

Amount \$ _____

Name: _____

Division: _____

Amount \$ _____

Name: _____

Division: _____

Amount \$ _____

End of Form

Division One

Section 01500 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

1.02 Facilities and Controls

J. Project Sign

1. The Contractor will erect on adequate supports and maintain one (1) neatly constructed and painted 3/4" thick plywood sign approximately four feet by eight feet (4' x 8'). The Professional will provide the colors, letters, layout and location of the sign. No other signs will be displayed on the job site without permission of the Professional. The displaying of sign advertisements is strictly prohibited

2. Sign to be white background with black lettering/seal. Text style to be Times New Roman. Color of rectangular field at bottom to be selected by Owner. Provide custom Using Agency logo at circular white field of up to three additional colors. No corporate logos for Architect or Contractor shall be permitted. Where additional rendered signage is specified elsewhere, it shall consist of (1) or (2) additional 4'x8' panels, contiguous to the right side of primary project sign.

BOB Procedure Manual:

700.19

PROJECT SIGN (new State Seal per Legislature July 1, 2014)

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**THIS PROJECT IS FUNDED BY THE TAXPAYERS OF
MISSISSIPPI**

GOVERNOR PHIL BRYANT

PROJECT NAME

GS# 111-111

HB1111 or SB1111, LAWS OF 1111

DEPARTMENT OF FINANCE & ADMINISTRATION

BUREAU OF BUILDING, GROUNDS & REAL

PROPERTY MANAGEMENT

ARCHITECT

ARCHITECT NAME

CONTRACTOR

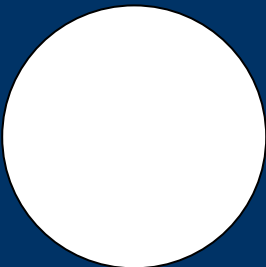
CONTRACTOR NAME

MISSISSIPPI C.O.R. #11111

USING AGENCY NAME

HEAD OF USING AGENCY NAME

GOVERNING BOARD (WHERE APPLICABLE)



PART 3 - ALTERNATE SUPPLEMENT

3.01 DESCRIPTION OF ALTERNATES

1. Deductive Alternate No. 1: A Deductive Proposal is required for omitting all labor, material and equipment necessary to furnish and install the Amphitheater, complete as indicated on the drawings and in accordance with the specifications.
2. Deductive Alternate No. 2: A Deductive Proposal is required for omitting all labor, material and equipment necessary to furnish and install Fixed Audience Seating and Multiple Seating Systems, complete as indicated on the drawings and in accordance with the specifications.
3. Deductive Alternate No. 3: A Deductive Proposal is required for providing all labor, material and equipment necessary to furnish and install Porcelain Tile and Base on the Second and Third floors, complete as indicated on the drawings and in accordance with the specifications in lieu of Thin-Set Epoxy Terrazzo Flooring System and Base.
4. Deductive Alternate No. 4: A Deductive Proposal is required for providing all labor, material and equipment necessary to furnish and install the Water Treatment Softener System, complete as indicated on the drawings and in accordance with the specifications.

PART 4 - PROJECT SEQUENCE

4.01 COORDINATION

Coordinate all work with the Owner

4.02 SEQUENCE

N/A

PART 5 - RAIN DAYS ALLOWANCE

5.01 As included in Article 8 - Time of the General Conditions, weather delays will be allowed as follows:

A. Rain Days

1. The contractor shall figure the following number of rain days for each month listed below in his schedule. These are based on a five-year average from weather data.

January - 7 days	February - 7 days	March - 7 days	April - 5 days
May - 6 days	June - 5 days	July - 6 days	August - 6 days
September - 4 days	October - 2 days	November - 4 days	December - 7 days

2. Request for rain days shall not be made unless the number of days per month when the rain precipitation amounting to 1/10" or more exceeds the number of days on the above chart.
3. For an extension of time for rain days to be considered, the contractor must document that the exterior work was delayed due to inclement weather conditions. In addition, the contractor shall provide the Professional with independent verification of the quality of days when rainfall exceeded 1/10" during each billing period.

Division One

SECTION 01575 TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.01 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. Environmental Protection Agency (EPA) Regulations:

40 CFR 261 National Hazardous Waste Management Program

40 CFR 403 General Pretreatment Standards

40 CFR 761 Polychlorinated Biphenyls

PL 96-510 Comprehensive Environmental Response,
 Compensation and Liability Act of 1980

B. Occupational Safety and Health Administration (OSHA) Publications:

29 CFR 1910 Safety and Health Standards

1.02 ENVIRONMENTAL PROTECTION PLAN

A. The Contractor shall be responsible for the preparation and submission of an environmental protection plan. After the contract is awarded, prior to the commencement of the work, the Contractor shall meet with the Architect, or his representative, and discuss the proposed environmental protection plan. The meeting shall develop mutual understanding relative to details of environmental protection, including required reports and measures to be taken should the Contractor fail to provide adequate protection in an adequate and timely manner. Not more than 14 days after the meeting, the Contractor shall submit for approval his proposed environmental protection plan.

1.03 GENERAL REQUIREMENTS:

A. The Contractor shall provide and maintain environmental protection during the life of the

contract as defined herein. Environmental protection shall be provided to correct conditions that develop during the construction of permanent environmental protection features, or that are required to control pollution that develops during normal construction practices but are not associated with permanent control features incorporated in the project. The Contractor's operations shall comply with all federal, state and local regulations pertaining to water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

- B. DESCRIPTION: The work covered by this section consists of furnishing all labor, materials and equipment, and performing all work required for the prevention of environmental pollution during, and as a result of, the work required under this contract, except for those measures set forth in other Technical Provisions of these specifications. For the purpose of this specification, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic and recreational purposes. The control of environmental pollution requires consideration of air, water, and land, and involves noise control, solid waste-management, as well as control of other pollutants.
- C. APPLICABLE REGULATIONS: To prevent and to provide for abatement and control of any environmental pollution arising from the work of the Contractor and his subcontractors in the performance of this contract, they shall comply with all applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement, all applicable provisions of the Corps of Engineers Manual EM-385-1-1, entitled "General Safety Requirements", in effect on the date of solicitation, and the specific requirements stated elsewhere in the contract specifications.

PART 2 - DEFINITIONS OF CONTAMINANTS

2.01 SEDIMENT:

- A. Soil and other debris that has been eroded and transported by runoff water.

- 2.02 SOLID WASTE:
A. Rubbish, debris, garbage and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
- 2.03 RUBBISH:
A. A variety of combustible and noncombustible wastes such as paper, boxes, and glass and crockery, metal and lumber scrap, tin cans, and bones.
- 2.04 DEBRIS:
A. Includes both combustible and noncombustible wastes, such as ashes, waste materials that result from construction or maintenance and repair work, leaves, and tree trimmings.
- 2.05 HAZARDOUS WASTE:
A. As defined in EPA Regulations 40 CFR 261 (IDENTIFICATION OF HAZARDOUS WASTE) and/or appropriate state regulations.
- 2.06 HAZARDOUS SUBSTANCE:
A. As defined in Public Law 96-510 CERCLA.
- 2.07 HAZARDOUS MATERIAL:
A. As defined in DOT Regulation 49 CFR 171 and listed in 49 CFR 172.
- 2.08 OILY SUBSTANCE:
A. Includes petroleum products and bituminous materials.
- 2.09 SANITARY WASTES:
A. Sewage: That which is considered as domestic sanitary sewage.
B. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing and consumption of food.
- 2.10 ASBESTOS AND ASBESTOS MATERIAL:
A. Asbestos means actinolite, amphibole, amosite, anthophyllite, chrysotile, crocidolite and tremolite. Asbestos material means asbestos or any material containing asbestos (such as asbestos waste, scrap, debris bags, containers, equipment, and asbestos-contaminated clothing consigned for disposal).

PART 3 - PROTECTION OF NATURAL RESOURCES

3.01 GENERAL:

- A. It is intended that the natural resources within the project boundaries and outside the limits of permanent work performed under this contract be preserved in their existing condition or be restored to an equivalent or improved condition upon completion of the work. The Contractor shall confine his construction activities to areas defined by the work schedule, plans, and specifications.

3.02 REPAIR OR RESTORATION:

- A. All trees or other landscape features scarred or damaged by the Contractor's equipment or operations shall be repaired and/or restored to their original condition at the Contractor's expense. The Architect shall approve the repair and/or restoration prior to its initiation.
- B. Temporary Construction: The Contractor shall obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and all other vestiges of construction. Temporary roads, parking areas and similar temporary use areas shall be graded in conformance with surrounding areas, tilled and seeded. Seeding shall include topsoil and/or nutriment as necessary to establish a suitable stand of grass.

3.03 WATER RESOURCES:

- A. All work under this contract shall be performed in such a manner that any adverse environmental impact to water resources, where applicable, is reduced to a level that is acceptable to the Architect.
- B. Oily and Hazardous Substances: At all times, special measures shall be taken to prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water. Environmental requirements for the prevention of oil spill are contained in 40 CFR 112. For oil and hazardous substance spills which may be large enough to violate Federal, State or Local Regulations, the Architect shall be notified immediately.

3.04 HISTORICAL AND ARCHAEOLOGICAL RESOURCES:

- A. All items having any apparent historical or

archaeological interest which are discovered in the course of any construction activities shall be carefully preserved and reported immediately to the Architect for determination of actions to be taken.

PART 4 - EROSION AND SEDIMENT CONTROL MEASURES

4.01 BURN OFF:

A. Burn off of ground cover will not be permitted.

4.02 REDUCTION OF EXPOSURE OF UNPROTECTED ERODIBLE SOILS:

A. Earthwork brought to final grade shall immediately be finished as indicated and specified. Side slopes and back slopes shall be protected immediately upon completion of rough grading. All earthwork shall be planned and conducted in such a manner as to minimize the duration of exposure of unprotected soils.

4.03 TEMPORARY PROTECTION OF ERODIBLE SOILS:

A. Such methods as may be necessary shall be utilized to effectively prevent erosion and control sedimentation, including but not limited to the following:

B. Mechanical Retardation and Control of Runoff: The rate of runoff from the construction site shall be mechanically retarded and controlled. This includes construction of diversion ditches, benches, and berms, to retard and divert runoff to protected drainage courses.

C. Borrow: Borrow will not be permitted in areas where suitable environmental controls are not possible.

D. Vegetation and Mulch: Temporary protection shall be provided on all side and backslopes as soon as rough grading is completed or sufficient soil is exposed to require protection to prevent erosion. Such protection shall be by accelerated growth of permanent vegetation, temporary vegetation, mulching or netting. Slopes too steep for stabilization by other means shall be stabilized by hydroseeding, mulching anchored in place, covering by anchored netting, sodding, or such combination of these and other methods as indicated and as may be necessary for effective erosion control.

PART 5 - CONTROL AND DISPOSAL OF WASTES

5.01 GENERAL:

A. Wastes shall be picked up and placed in containers which are emptied on a regular schedule. All handling and disposal shall be so conducted as to prevent contamination of the site and any other areas. On completion, the areas shall be left clean and natural looking. All signs of temporary construction and activities incidental to construction of the required permanent work in place shall be obliterated.

5.02 DISPOSAL OF RUBBISH AND DEBRIS: The disposition shall be as follows:

A. Removal from School Property: Contractor shall transport all waste off school property and dispose of it in a manner that complies with federal, state and local requirements. The Contractor shall provide the Architect a copy of state and/or local permit or license which reflects such agency's approval and his compliance with their solid waste disposal regulations. The permit or license and the location of the disposal area shall be provided prior to transporting any material off school property.

5.03 GARBAGE DISPOSAL:

A. Where the construction project is located in an area where garbage collection by the station is accomplished on a scheduled basis, the Contractor shall place garbage in an appropriate container and the station will provide pickup and disposal service. In areas where there is no scheduled garbage collection, the Contractor shall transport the garbage to a pickup point or disposal area. The preparation, cooking, and disposing of food is strictly prohibited on the project site.

PART 6 - DUST CONTROL

6.01 Dust shall be kept down at all times, including non-working hours, weekends and holidays. Soil at the site, haul roads and other areas disturbed by the Contractor's operations shall be sprinkled or treated with dust suppressors as necessary to control dust. No dry power brooming will be permitted. Vacuuming, wet mopping, wet sweeping, or wet power brooming shall be used instead. Air blowing will be permitted only for cleaning off

nonparticulate debris, such as reinforcing bars. No sandblasting will be permitted unless the dust therefrom is confined. Only wet cutting of concrete blocks, concrete and asphalt will be permitted.

PART 7 - NOISE

- 7.01 The maximum use of "low-noise-emission products" as certified by the Environmental Protection Agency shall be made when available. No blasting or use of explosives will be permitted.

END OF SECTION

SECTION 02.010 GEOTECHNICAL INVESTIGATION

PART 1 GENERAL

1.01 GENERAL

A. The Geotechnical Investigation is included for informational purposes only in Appendix "A".

END OF SECTION

SECTION 02011 CONSTRUCTION STAKING

PART 1 - GENERAL

1.01 SCOPE

- A. The Contractor shall provide and pay for field engineering services for:
1. Survey work required in layout and execution of work.
 2. Civil, structural, or other professional engineering services specified or required to execute the Contractor's construction method.
- B. The method of field staking for the construction of the work shall be at the option of the Contractor. The Owner shall provide the engineering surveys to establish reference points which in his judgment are necessary to enable the Contractor to proceed with his work.
- C. The accuracy of any method of staking shall be the responsibility of the Contractor. All engineering for vertical and horizontal control shall be the responsibility of the Contractor.
- D. The Contractor shall be held responsible for the preservation of all stakes and marks. If any stakes or marks are carelessly or willfully disturbed by the Contractor, the Contractor shall not proceed with any work until he has reestablished such points, marks, lines and elevations as may be necessary for the prosecution of the work.
- E. The Contractor shall retain the services of a competent surveyor or engineer registered in the State of Mississippi to layout the work and maintain a survey during construction. The Contractor shall be solely responsible for proper location of the work.
- F. Requirements to construction staking, as applicable, in The Mississippi Department of Transportation Standard Specification for Road and Bridge Construction, latest edition, is adopted and made a part of these specifications. Requirements pertaining to tolerances and staking intervals shall be adhered to as specified in those specifications.

1.02 SURVEY REFERENCE POINTS

Locate and protect control points prior to starting site work, and preserve all permanent reference points during construction.

- A. Make no changes or relocations without prior written notice to the Engineer.
- B. Report to the Engineer when any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations.
- C. Require surveyor to replace control points which may be lost or destroyed. Establish replacements based on original survey control.

1.03 PROJECT SURVEY REQUIREMENTS

- A. Establish temporary bench marks as needed, referenced to data established by survey control points. Record locations, with horizontal and vertical data, on Record Drawings.
- B. Establish lines and levels, and locate and lay out, by instrumentation and similar appropriate means:
 - 1. Site improvements, including utility slopes and invert elevations.
 - 2. Batter boards for structures.
 - 3. Controlling lines and levels required for mechanical and electrical trades.
- C. From time to time, verify layouts by same methods.
- D. Establish all lines and grades prior to construction of pipe work for all utility lines at 100 foot increments and at all changes in directions.

1.04 RECORDS

- A. Maintain a complete, accurate log of all control and survey work as it progresses.
- B. At Contract closeout submit a survey of installation of structures and pipelines at the same scale as the Engineer's drawings indicating elevations and pipe stationing at 100 foot increments and at all valve and fittings locations.

1.05 SUBMITTALS

- A. On request of the Engineer, submit documentation to verify accuracy of field engineering work.
- B. Submit drawings showing locations of all pipes and structures constructed. This drawing shall be included with the record drawings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED).

END OF SECTION

SECTION 02014 TESTING LABORATORY SERVICES FOR SITE WORK

PART I - GENERAL

1.01 SCOPE

- A. The CONTRACTOR will employ and pay for the services of an independent laboratory to perform construction testing. Requirements to construction testing, as applicable, in The Mississippi Department of Transportation Standard Specification for Road and Bridge Construction, latest edition, is adopted and made a part of these specifications. All requirements included in those specifications, included but not limited to material requirements, test frequencies, compaction tests, material strengths, etc., are made a part of these specifications.
- B. Laboratory's Duties:
1. Upon notice cooperate with ENGINEER and CONTRACTOR to promptly provide qualified personnel. Perform specified inspections, sampling and testing of materials and methods of construction to ascertain compliance with requirements of contract documents. Promptly notify ENGINEER and CONTRACTOR of irregularities or deficiencies of work observed during performance of services.
 2. Promptly prepare reports of inspections and tests including:
 - a. Date issued
 - b. Project title and number
 - c. Testing laboratory, name and address
 - d. Name and signature of inspector
 - e. Date of inspection or sampling
 - f. Record of temperature and weather
 - g. Date of test
 - h. Identification of product and specification section
 - i. Location of project
 - j. Type of inspection or test
 - k. Observations regarding compliance with contract documents
 3. Promptly distribute copies of reports of inspections and tests to:
 - a. OWNER
 - b. ARCHITECT
 - c. ENGINEER
 - d. General CONTRACTOR
 - e. Subcontractor, when pertinent

D. CONTRACTOR's Responsibilities:

1. Cooperate with laboratory personnel to provide access to work and to manufacturer's operation. Provide to laboratory in required quantities, preliminary representative samples of materials to be tested. Provide facilities for laboratory's exclusive use for storage and curing of test samples. Notify laboratory sufficiently in advance of operations to allow for his assignment of personnel and scheduling of tests.
2. Arrange and pay for additional samples and tests required for CONTRACTOR's convenience. When initial tests indicate work does not comply with contract documents, the CONTRACTOR may employ and pay for the services of a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing.

END OF SECTION

SECTION 02220 SITE DEMOLITION AND REMOVAL

PART 1 GENERAL

- 1.01 SECTION INCLUDES: This section includes all work up to and outside of existing buildings that remain as indicated on the drawings.
- 1.02 GENERAL REQUIREMENTS: Do not begin demolition until authorization is received from the Architect. Remove rubbish and debris from the station daily; do not allow accumulations inside or outside the buildings. Store materials that cannot be removed daily in areas specified by the Architect.
- 1.03 SUBMITTALS: Submit proposed salvage, demolition and removal procedures to the Architect for approval before work is started. Include procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, and a detailed description of methods and equipment to be used for each operation and of the sequence of operations.
- 1.04 REGULATORY REQUIREMENTS: Comply with federal, state, and local hauling and disposal regulations.
- 1.05 DUST CONTROL: Prevent the spread of dust to occupied portions of the building and avoid the creation of a nuisance in the surrounding area. Do not use water if it results in hazardous or objectionable conditions, such as, but not limited to, ice, flooding, or pollution.
- 1.06 PROTECTION
- A. Traffic Control Signs: Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Notify the Architect prior to beginning such work.
 - B. Existing Work: Protect existing work which is to remain in place, be reused, or remain the property of the Owner. Repair items which are to remain or which are to be salvaged and which are damaged during performance of the work shall be repaired to their original condition or replace with new. Do not overload structural elements or pavements to remain.

Provide new supports and reinforcement for existing construction weakened by demolition or removal work. Repairs, reinforcement, or structural replacement must have Architect approval.

- C. Trees: Protect trees within the project site that might be damaged during demolition and that are indicated to be left in place, by a 6-foot-high fence. Erect fence a minimum of 5 feet from the trunks of individual trees or follow the outer perimeter of branches of clumps of trees. Restore trees scarred or damaged by Contractor equipment or operations to a satisfactory condition or replace as determined by the Architect. The Architect shall approve restoration prior to its initiation.
- D. Facilities: Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities.

1.07 BURNING: Burning will not be permitted.

1.08 PRODUCTS (NOT APPLICABLE)

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 EXISTING FACILITIES TO BE REMOVED

- A. Structures: Remove indicated existing structures to 1 foot below existing adjacent or new finished grade, whichever is lower.
- B. Paving and Slabs: Remove sawcut concrete and asphaltic concrete paving and slabs including aggregate base as indicated to a depth of 12 inches below existing adjacent or new finished grade, whichever is lower. Provide neat sawcuts at limits of pavement removal as indicated.
- C. Drainage Structures and Pipe: Remove completely as indicated.

3.02 RESTORATION OF DISTURBED AREAS: Fill areas with select fill where structures, slabs or utilities have been removed

to match existing adjacent elevations. Fine grade so that restored areas do not hold water. Filling and grading shall be done in accordance with Section 02300, "Earthwork."

3.03 DISPOSITION OF MATERIAL

- A. Title to Materials: Except where indicated otherwise as salvage or specifically specified otherwise in other sections, all materials and equipment removed, and not reused, shall become the property of the Contractor and shall be removed from school property. Title to all materials resulting from demolition, and all materials and equipment to be removed, is vested in the Contractor upon approval by the Architect of the Contractor's demolition and removal procedures, and authorization by the Architect to begin demolition. The owner will not be responsible for the condition or loss of, or damage to, such property after notice to proceed. Materials and equipment shall not be viewed by prospective purchasers or sold on the site.
- B. Reuse of Materials and Equipment: Carefully remove and store materials and equipment indicated to be reused or relocated to prevent damage, and reinstall as the work progresses.
- C. Salvaged Materials and Equipment: Carefully remove materials and equipment that are indicated and specified to be removed by the Contractor and that are to remain the property of the Owner, and deliver to a storage site on the station as directed by the Architect.

3.04 CLEANUP

- A. Debris and Rubbish: Remove and transport debris and rubbish in a manner that will prevent spillage on streets or adjacent areas. Clean up spillage from streets and adjacent areas. Other applicable requirements are included under Section 01575, "Temporary Environmental Controls".
- B. Regulations: Comply with federal, state, and local hauling and disposal regulations.

END OF SECTION

SECTION 02222 EXCAVATING, TRENCHING AND BACKFILLING FOR
UNDERGROUND PIPING AND UTILITIES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Excavating, trenching and backfilling for the demolition and installation of underground storm drainage system.
- B. Excavation by open cut unless otherwise shown on the drawings.

1.02 REFERENCE CODES & STANDARDS: The Mississippi Standard Specifications for Road and Bridge Construction, 1990 Edition, referred to hereinafter as the Mississippi Standard Specifications (MSS). All references to method of measurement and basis of payment shall be deleted.

1.03 QUALITY CONTROL

- A. Testing Laboratory and Payment: Contractor shall furnish all testing.
 - 1. Density tests required, at the discretion of the Architect.
 - 2. Bedding Material: One test each 200 L.F.
 - 3. Select Backfill Around Pipe: One test each 200 L.F. for each 12-inch lift.
 - 4. Architect may, at his discretion, request alternate locations to be tested.

1.04 SUBMITTALS

- A. Certified Laboratory Test Reports:
 - 1. Select material for controlled fills
 - 2. Sand material for blanket drain
 - 3. Granular subbase

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 SURVEYING

- A. Lines and Grades:
 - 1. Alignment, benchmarks, and grade control stakes shall be provided by the Contractor. Control

points are shown on the drawings.

2. True alignment and gradient control by laser beam or another Architect approved method is required.

3.02 TRENCHING

- A. Trenches shall be dug so that the new pipe can be laid to the alignment and depth required, and shall be excavated only so far in advance of pipe laying as to reveal obstructions. The trench shall be so braced and drained that workmen may work therein safely and efficiently. Discharge from dewatering pumps shall be conducted to natural drainage channels, drains, or storm sewers.
- B. The width of the trench shall be ample to permit the existing pipe to be removed and the new pipe to be laid and jointed properly and the backfill to be placed and compacted as specified.
- C. The trench shall be excavated to the depth required to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground at every point.
- D. Any part of the trench excavated below the specified grade shall be corrected with approved material and thoroughly compacted. The finished subgrade shall be prepared accurately by means of hand tools.
- E. The subgrade beneath the centerline of the pipe shall be finished to within 0.03 foot of a straight line between pipe joints or batter boards, and all tolerances shall be above the specified grade.
- F. Where the bottom of the trench at grade is found to be unstable or to include pieces of wood, refuse or organic materials, or larger pieces of fragments of inorganic material which should be removed, the Contractor shall excavate and remove such unsuitable material to the width and depth determined by the Architect. Before the pipe is laid, the subgrade shall be made by backfilling with selected excavated material, crushed stone or sand. The layers shall then be compacted so as to provide uniform and continuous bearing and support for the pipe at every joint.
- G. Where trench conditions are such that adequate support for the pipe cannot be obtained on the native material, crushed stone bedding shall be used as indicated. Select sand shall then be used from the stone up to the top of the pipe. No additional

payment shall be made for such bedding/backfill.

- H. No greater length of trench shall be opened in advance of a completed pipeline nor left unfilled to the rear than shall seem proper to the Architect. No more than 50 feet shall be left open without being backfilled at the end of a workday.

3.03 SHEETING AND SHORING

- A. Place such sheeting and shoring in the trenches as may be necessary to support properly in the trench walls and any adjacent structures. The type and amount of sheeting and shoring shall be such as the nature of the ground and attendant condition may require. Provide such sheathing, shoring, and bracing as may be required for the safe conduct of the work. The Architect may, however, require trench stabilization where in his opinion it is necessary for provision of a finished product in accordance with these specifications. The cost of all such sheathing and shoring shall be included in the appropriate bid item.

3.04 PUMPING

- A. Keep all excavations free from water at the expense of the Contractor while pipe laying is in progress and to such extent as may be necessary while excavation work alone is being carried on. Provide for the disposal of the water removed from excavations in such manner as shall not cause injury to the public health, to public or private property, or to any part of the work complete or in progress, or any impediment to the use of the streets.

3.05 PIPE LAYING

- A. Lay the new pipe on a straight line and true grade between drainage structures and the end of the pipe segment being joined with the new pipe. Verify the invert elevation of each pipe segment and furnish this information to the Architect on a cut sheet prior to beginning excavation.
- B. Provide and use proper implements, tools and facilities for the safe and convenient prosecution of the work. All pipe, fittings, valves, and appurtenances shall be carefully lowered into the trench piece by piece by means of derrick, ropes or other suitable tools or equipment in such a manner as

to prevent damage to materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped into the trenches.

- C. Inspect all pipe, fittings, and appurtenances for defects and cracks prior to being lowered into the trench.
- D. The outside of the tongue, the inside of the groove, and any couplings used shall be brushed and wiped clean and dry and free from all foreign matter before the pipe is joined.
- E. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. If the pipe laying crew cannot put the pipe into the trench and in place without getting earth into it, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During the laying operations, no debris, tools, clothing or other material shall be placed in the pipe. After placing a length of pipe in the trench, the tongue shall be centered in the end of the pipe and forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it as herein specified. Precautions shall be taken to prevent dirt from entering the joint space.
- F. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Architect. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry. (The plug is not required to be watertight for storm drainage pipe.)
- G. All pipe shall be installed in accordance with the manufacturer's recommendations. The Contractor shall have copies of the installation manual available on the project at all times.

3.06 BACKFILLING TRENCHES

- A. Backfilling shall be made with the material removed from the trench or excavation provided that the excavated material is suitable for backfilling. Suitable materials shall be construed as material that will compact readily when the usual methods of mechanical tamping are used.
- B. All backfill material shall be free from cinders, ashes, roots, refuse, vegetable matter, excess organic

material, rocks, stones, or other unsuitable materials.

- C. All trenches shall be backfilled by hand or by approved mechanical methods from the bottom of the trench to the centerline of the pipe with fill placed in layers of 3-inches and compacted by tamping. Backfilling material shall be deposited in the trench for its full width of each side of the pipe, fittings, and appurtenances simultaneously. Care shall be exercised to prevent distortion or damage to the pipe.
- D. From the centerline of the pipe, fittings and appurtenances to a depth of 1 foot above the top of the pipe, the trench shall be backfilled in 6-inch layers and tamped by hand or by approved mechanical methods so as to insure that the backfill is well placed and compacted beneath the haunches of the pipe. Use special care in placing this portion of the backfill so as to avoid injuring or moving pipe.
- E. From 1 foot above the pipe to final grade, the trench shall be backfilled in layers which do not exceed 12 inches before compaction and shall be compacted with approved mechanical equipment to 95% of the maximum proctor density, ASTM D-1557.
- F. The Architect shall have the right to forbid the use of any compacting tools or machines that he considers dangerous to the pipe or incapable of compacting the backfill properly.
- G. Where sheathing or bracing is withdrawn as the backfilling progresses, all voids or spaces left thereby shall be carefully and thoroughly filled and compacted with properly shaped tools.
- H. After completion of backfilling, all materials not used therein, including any excess excavation, shall be removed and disposed of and all roads, shoulders and other places in the line of the work shall be left free, clean and in good order.

END OF SECTION

SECTION 02224 EARTHWORK FOR STRUCTURES

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Division 1 Sections

B. Section 02475 Aggregate Pier Foundation System

1.02 REFERENCES

ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils.

ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).

ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

Geotechnical Investigation, Technology Classroom Building, Alcorn State University, Lorman, Mississippi. Burns Cooley Dennis, Inc. Report No. 160092. March 31, 2016.

1.03 DEFINITIONS

A. Granular Subbase: Fill directly beneath slabs-on-grade.

B. Backfill: Fill immediately behind foundation elements or retaining walls.

C. Structural Fill: Fill under the structure other than the granular subbase.

1.04 QUALITY ASSURANCE

A. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

1.05 SURVEY

A. Prior to construction, have structure location staked and certified by a licensed surveyor. If discrepancies between actual lines and elevations exist, notify Architect/Structural Engineer before proceeding with layout of structure.

1.06 SUBSURFACE CONDITIONS

A. Copies of a subsurface investigation of the site will be made available upon request. The data is not intended as a representation or warranty of the continuity of such conditions. Owner will not be responsible for interpretation or conclusions drawn by the Contractor. The data is made available for the convenience of the Contractor and is not guaranteed to represent all conditions that may be encountered.

B. Contractor may examine the site and make his own subsurface explorations at no additional cost to the Owner. Notify Owner prior to making any subsurface explorations.

1.07 EXISTING UTILITIES

A. Locate existing underground utilities by careful hand excavation. If utilities are to remain in place, provide protection from damage during construction operations.

B. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Do not interrupt existing utility service facilities occupied and used by Owner or others, unless written permission is given by the Architect and then only after temporary utility services have been provided.

C. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Architect immediately for directions.

D. Repair damaged utilities to satisfaction of utility owner.

1.08 NOTICE

A. Notify the Architect/Structural Engineer 48 hours prior to the beginning of any excavation work.

PART 2 PRODUCTS

2.01 GRANULAR SUBBASE (DRAINAGE COURSE)

A. Granular Subbase: Sound and free-draining, such as gravel or crushed stone with less than 10% passing the 200 sieve. (Maximum diameter shall be 1-1/2 inches) or sand with 10%-15% passing the #200 sieve.

2.02 BACKFILL

A. Soil Materials: Provide materials free from debris, roots, wood, scrap materials, vegetable matter, refuse or frozen material. Maximum particle size permitted is 3 inches. Use excavated material from the site for the work indicated when material falls within the requirements specified herein.

1. Controlled Fill and Backfill:

a. Above One Foot Above Static Water Table: Provide under structures, utilities, spread footings, paving and concrete slabs on grade materials classified as SM, SP or SC by ASTM D 2487. The liquid limit of such material shall not exceed 25 percent when tested in accordance with ASTM D 4318. The plasticity index shall not be greater than 12 percent when tested in accordance with ASTM D 4318, and not more than 25 percent by weight shall be finer than No. 200 sieve when tested in accordance with ASTM D 1140.

- b. Below One Foot Above Static Water Table: Fill material placed below one foot above static water table shall be a "clean" sand with less than 10 percent of material (by weight) finer than No. 200 mesh sieve.
2. General Backfill Adjacent to Structures: No soft, spongy, highly plastic, or otherwise unstable material is permitted. Material shall be classified as SP, SM, or SC by ASTM D 2487. If more material is required than is available from on-site excavation, then provide that material from approved sources.
3. Topsoil: Provide material free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material or substance detrimental to plant growth. Topsoil shall be a natural, friable soil representative of productive soils in the vicinity.
4. Borrow: Provide materials meeting requirements for general site fill, fill, backfill, and topsoil. Obtain borrow materials in excess of those furnished from excavations describes herein from sources off Project site property.

PART 3 EXECUTION

3.01 STRIPPING

- A. Strip vegetation, topsoil, roots, and other unsuitable material to a depth determined by the Special Inspector but not less than one foot, nor less than 10 feet outside the perimeter of the structure.
- B. Stockpile sufficient amounts of topsoil as required to cover areas to be landscaped with a minimum of six inches of material.

3.02 EXCAVATION

- A. Excavation shall be considered unclassified. Excavations shall comply with U.S. Department of Labor, Occupation Safety and Health Administration (OSHA) regulations.
- B. Perform excavation to the depths and limits in the Structural Drawings and as specified herein.
- C. Do not excavate to full depth when there is probability of frost forming or ground freezing in excavation before concrete is placed.
- D. Ground water may be encountered during the foundation excavation. Provide a system for controlling the ground water to a level at least three feet below the lowest point of the excavation.
- E. Keep excavations dry by sloping ground away from holes and trenches.

3.03 PROOFROLLING

- A. After stripping or excavation and before any fill placement, fill areas shall be proofrolled with a minimum of two coverages of a loaded dump truck or scraper in each of two perpendicular directions.
- B. Areas found to be soft or pumping shall have the soft soil removed and replaced with structural fill and compacted as outlined herein.

3.04 PLACEMENT OF STRUCTURAL FILL

- A. Do not place structural fill on subgrade that contains frost, mud or is frozen.
- B. Structural fill shall be placed and compacted in 9-inch thick loose layers.
- C. Compact structural fill to 95 percent of the maximum dry density as measured by Modified Proctor, ASTM D1557.

3.05 PLACEMENT OF BACKFILL

- A. Backfill behind wall shall be placed in layers of six inches.
- B. Compact backfill behind walls to 95 percent of the maximum dry density as measured by Modified Proctor, ASTM D1557.

3.06 PLACEMENT OF GRANULAR SUBBASE

- A. Do not place granular subbase on subgrade that contains frost, mud or is frozen.
- B. Compact granular subbase to 95 percent of the maximum dry density as measured by Standard Proctor, ASTM D698.

3.07 CLEAN UP

- A. Remove excess excavated materials from job site and upon completion leave site in clean condition.

END OF SECTION

SECTION 02228 VEGETATIVE COVER

PART 1 - GENERAL

1.01 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. Federal Specifications (Fed. Spec.):
 - O-F-241D Fertilizers, Mixed, Commercial
 - Q-P-166E Peat Moss
- B. U. S. Department of Labor, Occupational Safety and Health Administration (OSHA) Occupational Safety and Health Standards:
 - 29 CFR Air Contaminants
 - 1910.1000
- C. U. S. Department of Agriculture (USDA) Publications:
 - Soil Survey Investigation Report No. 1, Soil Survey Laboratory Methods and Procedures for Collecting Soil Samples. Soil Conservation Service, April 1972
- D. American National Standards Institute (ANSI) Publication:
 - ANSI Z88.2-80 Practices for Respiratory Protection
- E. American Sod Producers Association, Inc. (ASPA) Publication:
 - Guideline Specifications for Sodding

1.02 DEFINITION

- A. Pesticide means soil fumigants, herbicides, insecticides and fungicides.

1.03 SUBMITTALS

- A. Certificates of Conformance
 - 1. Sod
 - 2. Fertilizer
 - 3. Topsoil
 - 4. Peat
- B. Laboratory Test Reports: Tests for Topsoil Composition specified in USDA Soil Survey Investigation Report No. 1.
- C. Manufacturer's Data: Including physical characteristics, application and installation instructions, and recommendations:
 - 1. Pesticides
- D. Delivery Schedule: Submit at least 10 days before delivery.

- E. Pesticide Control Plan: Submit proposed sequence of pesticide work. Include common name, chemical composition, formulation, concentration, rate and method of application, for all materials furnished; and names of state certified applicator(s), in the appropriate category.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Protect sod from drying out and from contamination during delivery, on-site storage, and handling.
2. Deliver fertilizer and lime to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and Federal laws. Instead of containers, fertilizer and lime may be furnished in bulk with certificate indicating the above information.
3. Deliver pesticide materials to the site in the original unopened containers with legible label indicating Environmental Protection Agency (EPA) registration number and manufacturer's registered uses.

B. Storage:

1. Protect sod from exposure to wind and direct sunlight until planted. Provide covering that will allow air to circulate so that internal heat will not develop.
2. Store lime and fertilizer in cool, dry locations away from contaminants.
3. Do not store pesticides with other landscape materials.
4. Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Treat when foliage is 6 to 10 inches high and approximately 4 to 6 weeks prior to stockpiling.

C. Handling:

Do not drop or dump materials from vehicles.

1.05 TIME LIMITATION FOR SOD

- A. Limit the time between harvesting and placing sod as specified in the paragraph entitled, "Placing".

PART 2 PRODUCTS

2.01 SOD

- A. Classification: Certified as classified in the ASPA Guideline Specifications for Sodding. Machine cut sod at a uniform thickness of 3/4 inch within a tolerance of 1/4 inch, excluding top growth and thatch. Each individual sod piece shall be strong enough to support its own weight when lifted by the ends. Broken pads, irregularly shaped pieces, and torn or uneven ends will be rejected.

2.02 TOPSOIL

- A. Existing Soil: Modify existing soil to conform to the requirements specified in the paragraph entitled, "Composition".
- B. On-Site Topsoil: Reusable surface soil stripped and stockpiled on the site if requirements specified for topsoil in the paragraph entitled "Composition" are met.
- C. Off-Site Topsoil: Conform to requirements specified in the paragraph entitled, "Composition". Additional topsoil shall be furnished by the Contractor.
- D. Composition: Containing from 5 to 20 percent organic matter as determined by the Organic Carbon, 6A, Chemical Analysis Method described in USDA Soil Survey Investigation Report No. 1. Maximum particle size, 3/4-inch, with maximum 3 percent retained on 1/4-inch screen. Other components shall be within the following percentages:

Silt	25-50
Clay	10-30
Sand	20-35
pH	5 to 7.6
Soluble Salts	600 ppm maximum

2.03 SOIL CONDITIONERS

- A. Use singly or in combination as required to meet specified requirements for topsoil. Soil conditioners shall be nontoxic to plants.
 - 1. Peat: Peat moss derived from a freshwater site and conforming to Fed. Spec. Q-P-166 as modified herein. Shred and granulate peat to pass 1/2-inch mesh screen and condition in storage pile for minimum six months after excavation.
 - 2. Sand: Clean and free of materials harmful to

plants.

3. Composted Wood Derivatives: Ground bark, sawdust, or other wood waste material free of stones, sticks, and soil stabilized with nitrogen and having the following properties:
 - a. Particle Size: Minimum percent by weight passing:

No. 4 mesh screen	95
No. 8 mesh screen	80
 - b. Nitrogen Content: Minimum percent based on dry weight:

Redwood Sawdust	0.5
Fir Sawdust	0.7
Fir or Pine Bark	1.0
4. Calcined Clay: Granular particles produced from montmorillonite clay calcined to minimum temperature of 1200 degrees to the following gradation: minimum 90 percent passing 8-mesh screen, 99 percent retained on 60-mesh screen and, maximum 2 percent passing 100-mesh screen. bulk density: 40 pounds maximum per cubic foot.

2.04 FERTILIZER

- A. Controlled Release Fertilizer: Magnesium ammonia phosphate and magnesium potassium phosphate with nitrogen-phosphorus-potassium ratio of 5 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, granulated to pass through a 1/8-inch screen.

2.05 WATER

- A. Suitable quality for irrigation.

2.06 PESTICIDES

- A. Soil Fumigant, Herbicide, Insecticide and Fungicide: EPA registered and approved. Furnish for pre-emergence and post-emergences application for crabgrass control and broadleaf weed control.

PART 3 EXECUTION

3.01 TIME RESTRICTIONS AND PLANTING CONDITIONS

- A. Restrictions: Do not plant when the ground is frozen, snow covered or muddy.

3.02 PREPARATION

- A. Subgrade: After areas required to be turfed have been brought to the required subgrade, thoroughly till to minimum depth of 6 inches by scarifying, disking, harrowing, or other approved methods. Remove debris and stones larger than one inch in any dimension remaining on surface after tillage.
- B. Topsoiling: Immediately prior to placing topsoil, scarify subgrade to a 2-inch depth for bonding of topsoil with subsoil. Spread topsoil evenly to a minimum depth of 4 inches. Do not spread topsoil when frozen or excessively wet or dry. Correct irregularities in finished surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.
- C. Fertilizer, pH Adjusters, and Soil Conditioners:
 - 1. Apply fertilizer, pH adjuster and soil conditioner at rates and analysis as determined by laboratory soil tests of the soils at the job site. Apply at rates recommended by manufacturer.
 - 2. Incorporate fertilizer, pH adjusters, and soil conditioners into soil to minimum depth of 6 inches. This may be done as part of the subgrade tillage operation specified herein.
- D. Application of Pesticides:
 - 1. Hydraulic equipment for liquid application of chemicals shall have leakproof tanks and positive agitation method, plus gauges and valves capable of maintaining constant application pressures. Calibrate and meter equipment so that application of chemicals in specified amounts can be determined.
 - 2. Apply all herbicides and other chemicals in accordance with EPA label restrictions and recommendations and Federal and state laws. Make daily reports to the Architect stating areas treated with each chemical, the quantity applied, and spray mixture or formulation used. Application at each site shall be under the supervision of a certified applicator.
 - 3. Apply in well ventilated areas. Avoid inhalation, injection, or spilling on clothing or skin. Wear protective clothing in accordance with manufacturer's material safety data sheet recommendations. Personnel shall not be exposed to pesticides exceeding the exposure levels recommended in the most stringent of the

following: OSHA, 29 CFR 1910.1000, or the manufacturer's material safety data sheet. If excessive exposures are unavoidable, use respirators approved by the National Institute for Occupational Safety and Health for protection from pesticides, fumigants, herbicides and fungicides. Conform to the selection and usage guidance in ANSI Z88-2.

4. Apply so damage will not result to personnel or property from either direct spray or drifting of chemicals both on and off Government property.
5. Dispose of excess chemicals and containers in accordance with section 01575, "Temporary Environmental Controls".

3.03 SODDING

- A. Placing: Place sod a maximum of 36 hours after initial harvesting, in accordance with ASPA Guideline Specifications for Sodding as modified herein. Thoroughly moisten areas to be sodded immediately prior to placing sod.
- B. Sodding Slopes and Ditches: For slopes 2:1 and greater, lay sod with long edge parallel to slope. For V-ditches and flat bottomed ditches, lay sod with long edge parallel to flow of water. Anchor each piece of sod with wood pegs or wire staples maximum 2 feet on center. On slope areas, start sodding at bottom of the slope.
- C. Finishing: After completing sodding, blend edges of sodded area smoothly into surrounding area.
- D. Watering: Start watering immediately after completing each day's sodding. Apply water at a rate sufficient to ensure thorough wetting of the soil to minimum depth of 4 inches.

3.04 TURF ESTABLISHMENT PERIOD

- A. Definitions:
 1. Turf establishment period will be in effect until the turf has been mowed three times.
 2. A stand of turf is 95 percent ground cover of the established species.
- B. Maintenance During Turf Establishment Period:
 1. Mow turfed area to an average height of 1 inch whenever average height of grass becomes 1-1/2 inches.
 2. Mow, remove excess clippings, eradicate weeds, water, fertilize, overseed, and perform other

operations necessary to promote turf growth.

3.05 FINAL ACCEPTANCE

- A. Final Inspection and Acceptance: Final inspection will be made upon written request from the Contractor at least 10 days prior to the last day of the turf establishment period. Final acceptance will be based upon a satisfactory stand of turf as defined in the paragraph entitled, "Turf Establishment Period".
- B. Replanting: Replant, within specified planting dates, areas which do not have a satisfactory stand of turf.

END OF SECTION

SECTION 02231 - CLEARING AND GRUBBING

PART 1 GENERAL

1.01 DESCRIPTION

A. This work shall consist of clearing and grubbing of area specifically designated on the Drawings within construction limits and related items to complete the work as indicated and described herein.

1.02 NOTIFICATION OF UTILITY COMPANIES

A. In accordance with Mississippi Law, the Contractor shall call the Dig Line (800-227-6477), prior to any excavation, tree removal, etc.

B. Before beginning any earthwork operation, prepare and maintain on job site requirements Construction Notice of Intent per Mississippi Department of Environmental Quality.

PART 2 PRODUCTS - NOT APPLICABLE

PART 3 EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. Clearing shall consist of the removal and ultimate disposal of all trees (except trees indicated to remain), stumps, brush, vines, logs and other debris as indicated on the drawings and as required on utility easements to permit efficient construction operations. Proposed clearing limits shall be established and identified by the Contractor with flagged stakes for approval by the Architect. Clearing operations shall not begin before such approval by the Architect is obtained. Brush, refuse, stumps, roots and timber shall become the property of the Contractor and removed from the property.

B. Grubbing shall consist of the removal and ultimate disposal of all stumps larger than 1-1/2 inches in diameter to a depth of not less than one (1) foot below finished grade. Holes resulting from grubbing operations shall be filled in layers not exceeding twelve (12) inches to the elevation of the adjacent ground surface and each layer shall be compacted to a density at least equal to the adjoining undisturbed material.

C. Protect all existing property not to be removed from injury which may result from work required by this section. Damage caused by these operations shall be repaired or replaced. This liability shall extend to existing paved areas only to the extent of damage

resulting through Contractor's improper use of such areas or negligence related thereto.

- D. Any streets, roadways, sidewalks, grounds, plantings, trees or other property that may be damaged as a result of this work shall be properly repaired or fully replaced by the Contractor to the full satisfaction of all interests involved.

3.02 SAFETY CODES AND STANDARDS

- A. The Contractor shall conduct all operations in such manner as not to jeopardize life or property. He shall brace, shore, barricade or protect all areas where he is working, and shall provide all necessary devices as needed for construction and protection of life and property.

END OF SECTION

SECTION 02270 EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The work specified in this section consists of providing and maintaining erosion and sedimentation control measures during construction.
- B. Sedimentation control measures include silt fence and straw bale barriers and seeding and mulching as required to control erosion.
- C. The sedimentation control measures specified herein are minimum requirements. Additional requirements to meet sediment and erosion control ordinances shall be designed, installed and maintained by the CONTRACTOR.

1.02 REFERENCES DOCUMENTS

- A. Applicable soil erosion and sediment control ordinances in force by Federal, State and Local Governments.

1.03 QUALITY ASSURANCE

- A. Establish sediment control barriers prior to the beginning of clearing and maintain during the entire period of construction.
- B. Clean out and dispose of any sediment that inhibits the proper functioning of erosion control measurers or when the storage capacity of any sediment facility is reduced by one-half.

PART 2 - PRODUCTS

2.01 SEDIMENTATION CONTROL

- A. Straw Bales: Either wire bound or string tied with bindings oriented around sides rather than over and under.
- B. Pre-Manufactured Wattles
- C. Pre-manufactured silt fence: Acceptable fabrics:
 - 1. Silt Stop by American Excelsior Company - Arlington, Texas.
 - 2. Envirofence by Mirafi - Charlotte, North Carolina.
 - 3. Exxon GTF 100S by Exxon - Atlanta, Georgia.

PART 3 - EXECUTION

3.01 GENERAL

- A. Construct and maintain grass, silt fencing and straw bale barriers, as required to prevent and control the loss of soil from the construction site into the receiving waters.

3.02 STRAW BALE BARRIERS OR WATTLES

- A. Install straw bales or wattles around each storm drain entrance to prevent sediment from entering underground storm drains. Place each bale in a 4" trench and backfill to anchor and prevent undermining.
- B. Drive at least two stakes through each bale.
- C. Fill gaps between bales with wedging straw to prevent water from escaping between the bales.

3.03 SILT FENCE

- A. Install silt fence in locations as required.

- B. Install silt fence in accordance with the manufacturer's recommendations and details shown on the drawings.

3.04 WIRE FENCE

- A. Provide posts at 10'-0" o.c. maximum with a continuous wire fence similar to a 6"x6", 14 gage mesh behind silt fencing and attach to posts.

END OF SECTION

PART 1 GENERAL

1.01 DESCRIPTION

The work includes performing site preparation, excavation, borrow, filling, backfilling, compacting, and finished grading necessary to construct the finished grades indicated for structures, pavements and on-grade slabs or site work. Requirements for pavements and foundation and footing construction are specified in the respective sections for these systems or indicated on the drawings. Requirements for utility earthwork is in specification Section 02222.

1.02 DEFINITIONS

- A. Backfill: Material used in refilling a cut or other excavation.
- B. Cohesive Materials: Cohesive materials include materials classified by ASTM D 2487 as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesive only when fines have a plasticity index greater than zero.
- C. Cohesionless Materials: Cohesionless materials include materials classified by ASTM 2487 as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plasticity index of zero.
- D. Compaction: The process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of Compaction" is expressed as a percentage of the maximum density obtained by the test procedure described in D 1557 for general soil types abbreviated in this specification as "a percent ASTM D 1557 maximum density" as shown in Table 3.4.3.
- E. Controlled Fill: A fill consisting of a specified soil mix or gradation of materials constructed to attain maximum bearing strength and minimize consolidation or differential settlement under a load. Controlled fill is sometimes called "structural fill".
- F. Embankment: A "fill" having a top that is higher than adjoining ground.
- G. Excavation: The removal of soil, rock, or hard material to obtain a specified depth or elevation.

- H. Fill: Specified material placed at a specified degree of compaction to obtain and indicated grade or elevation.
- I. Granular Subbase: A dense, well-graded aggregate mixture of sand-gravel or crushed stone with suitable binder soil, placed on a subgrade to provide a suitable foundation for further construction.
- J. Hard Material: Weathered rock, dense consolidated deposits or conglomerate materials which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment with ripper teeth or the use of jack hammers for removal.
- K. Lift: A layer (or course) of soil placed on top of a previously prepared or placed soil in a fill or embankment.
- L. Plan Measure: Actual field measured, compacted volume of soil placed or excavated.
- M. Rock: Solid, homogenous, interlocking crystalline material with firmly cemented, Or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement, exceeding 1/2 cubic yard in volume. Removal of "hard material" will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.
- N. Soil: The loose surface material of the earth's crust resulting from the chemical and mechanical weathering of rock and organic material.
- O. Subgrade: The bottom layer of material (sometimes in situ soil or rock) graded or otherwise prepared for supporting the addition of fill material, pavement courses, or a building slab.
- P. Topsoil: In natural or undisturbed soil formations, the fine-grained, weathered material on the surface or directly below any loose or partially decomposed organic matter. Topsoil may be a dark-colored, fine, silty, or sandy material with a high content of well decomposed organic matter, often containing traces of the parent rock material. Gradation and material requirements specified herein apply to all topsoil

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references in this contract. The material shall be representative of productive soils in the vicinity.

- Q. Unsatisfactory Material: Existing, in-place soil or other material which can be identified as having insufficient strength characteristics or stability to carry intended loads in fill or embankment without excessive consolidation or loss of stability. Materials classified as CH, MH, PT, OH, or OL by ASTM D 2487 are unsatisfactory. Unsatisfactory materials also include vegetable matter, refuse, roots, or other deleterious or objectionable material.

1.03 SUBMITTALS

- A. Certified Laboratory Test Reports:
1. Select material for controlled fills
 2. Topsoil
 3. Surface dewatering plan
 4. Storm Water Pollution Prevention Plan

1.04 DELIVERY AND STORAGE

Deliver and store materials in a manner to prevent contamination or segregation.

1.05 CRITERIA FOR BIDDING

Base bids on the following criteria:

- A. Allow for Removal of unsuitable material and backfill with select fill in amount of 2500 CY (plan measure). Actual quantity of unsuitable material shall be field verified by the Architect/Engineer. The contract Sum shall be adjusted to the cost of the actual removal and backfill quantities based on a unit price of \$17.50 per cubic yard (in place, compacted and tested).
- B. Surface elevations are as indicated.
- C. No pipes or other man-made obstructions, except those indicated or noted, will be encountered.
- D. The character of the material to be excavated or used for subgrade is as indicated. Rock or hard material as defined in paragraph, "DEFINITIONS," will not be encountered.
- E. Ground water elevations indicated are those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.
- F. Suitable backfill and fill material in the quantities required is not available on Government property.

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- G. Blasting will not be permitted. Remove material in an approved manner.

1.06 PROTECTION

- A. Dewatering: Include the disposal of surface or ground water which may accumulate in open excavations, unfinished fills, or other low areas. Remove water by trenching where approved, pumping, or other methods to prevent softening of exposed surfaces. Dewatering plan shall include the rerouting of any ground water, storm water runoff or natural drainage if necessary and shall comply with all local environmental requirements.
 - 1. Surface Drainage: So that construction operations progress successfully, completely Drain construction site during periods of construction to keep soil material sufficiently dry. Provide temporary ditches, swales, and other drainage features and equipment is required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein.
 - 2. Subsurface Drainage: Base on site surface and subsurface conditions, available soil, and hydrological data. Remove water by pumping or other methods to prevent softening of surfaces exposed by excavation. Use filters on dewatering devices to prevent removal of fines from soil. Provide erosion control at outlet of piping to prevent erosion.
- B. Utilities: Contact the Architect 72 hours prior to construction or disturbance of all existing underground utilities. Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Excavation made with power-driven equipment is not permitted within two feet of any known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, use hand or light

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equipment excavation. Start hand or light equipment excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work as affected by the contract excavation until approval for backfill is granted by the Architect. Report damage to utility lines or subsurface construction immediately to the Architect.

- C. Protection and Restoration of Surfaces: Protect newly graded areas from traffic, erosion, and settlements. Repair and reestablish damaged or eroded slopes, elevations or grades and restore surface construction prior to acceptance. Protect existing ditches and storm drain inlets from water-borne soil. Conduct work in accordance with requirements specified in Section 01575, "Temporary Environmental Controls".

1.07 STORM WATER POLLUTION PREVENTION PLAN

- A. See Section 01575, "Temporary Environmental Controls".
- B. Prepare a Small Construction Notice of Intent (SCNOI) including a Stormwater Pollution Prevention Plan (SWPPP) according to Mississippi DEQ requirements. Maintain copy of SCNOI on job site throughout project term.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Soil Materials: Provide materials free from debris, roots, wood, scrap materials, vegetable matter, refuse or frozen material. Maximum particle size permitted is 3 inches. Use excavated material from the site for the work indicated when material falls within the requirements specified herein.
 - 1. Controlled Fill and Backfill:
 - a. Above One Foot Above Static Water Table: Provide under structures, utilities, spread footings, paving and concrete slabs on grade materials classified as SM, SP or SC by ASTM D 2487. The liquid limit of such material shall not exceed 25 percent when tested in accordance with ASTM D 4318. The plasticity index shall not be greater than 12 percent when tested in accordance with ASTM D 4318,

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and not more than 25 percent by weight shall be finer than No. 200 sieve when tested in accordance with ASTM D 1140.

- b. Below One Foot Above Static Water Table: Fill material placed below one foot above static water table shall be a "clean" sand with less than 10 percent of material (by weight) finer than No. 200 mesh sieve.
2. General Backfill Adjacent to Structures: No soft, spongy, highly plastic, or otherwise unstable material is permitted. Material shall be classified as SP, SM, or SC by ASTM D 2487. If more material is required than is available from on-site excavation, then provide that material from approved sources.
3. General Site Fill and Embankment Material: Provide a soil material from the borrow that can be readily compacted to the specified densities. Materials shall be unclassified.
4. Topsoil: Provide material free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material or substance detrimental to plant growth. Topsoil shall be a natural, friable soil representative of productive soils in the vicinity.
5. Borrow: Provide materials meeting requirements for general site fill, fill, backfill, and topsoil. Obtain borrow materials in excess of those furnished from excavations described herein from sources off Government property.
6. Drainage Course: Sandy, granular, free draining material with 10% to 15% passing a No. 200 sieve.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

- A. Stockpiling Topsoil: Strip approved topsoil to a minimum depth of 6 inches from the site where excavation or grading is indicated and stockpile separately from other excavated material. Locate topsoil so that the material can be used readily for the finished grading. Protect and store in segregated piles until needed.

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- B. Unsatisfactory Material: Remove organic matter, sod, muck, rubbish, and unsuitable layers under embankments and under pavements or slabs on grade. The maximum depth of removal of such unsuitable material shall be 36 inches.
 - 1. Subgrade Proof Rolling: After removal of topsoil or other overburden, proof roll the existing subgrade with 6 passes of a 15-ton pneumatic-tired roller. Operate the roller in a systematic manner to assure the number of passes over all areas, and at speeds between 2.5 and 3.5 miles per hour. When proof rolling under structures, one-half of the passes made with the roller shall be in a direction perpendicular to the other passes. Proof rolling shall be done in the presence of the Architect. Any rutting or pumping shall indicate unsatisfactory material and the material shall be undercut as directed by the Architect and replaced with the appropriate fill material.

3.02 EXCAVATION

Excavate to the contours and dimensions indicated. Keep excavations free from water while construction is in progress. Notify the Architect immediately in writing in the event that it becomes necessary to remove rock, hard material, or other material defined as unsatisfactory to a depth greater than indicated and an adjustment in contract price will be considered. Refill excavations cut below the depths indicated with fill and compact as specified herein. Excavate soil disturbed or weakened by the construction operations and soils permitted to soften from exposure to weather. Refill with fill and compact as specified herein at no additional cost to the Government.

- A. Excavation Under All Footings and Slab: Remove existing soils as indicated on drawings. Excavated materials may be used, if approved, as site fill in areas outside building or pavement areas.

3.03 BORROW MATERIALS

Select borrow materials to meet requirements and conditions of the particular fill to be used. Perform necessary clearing, grubbing, disposal of debris, and satisfactory

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drainage of borrow pits as incidental operations to the borrow excavation.

- A. Selection of Borrow Materials: Obtain borrow materials from sources off of school property.
- B. Borrow Pits: Excavate borrow pits to afford adequate drainage. Overburden and other soil material shall be stockpiled for refilling the borrow area.

3.04 FILLING AND BACKFILLING

- A. Filling and Backfilling Adjacent to Structures: Place backfill adjacent to structures and compact to prevent wedging action or eccentric loading upon or against the structures. Step or serrate slopes bounding or within areas to be backfilled to prevent sliding of the fill. Do not use equipment for backfilling operations or for the formation of embankments against structures that will overload the structure. Backfilling against concrete will be done only after approval has been obtained from the Architect.
- B. Controlled Fill and Backfill: Place backfill and fill as indicated on the drawings under spread footing, and concrete slabs, in lifts of 8 inches thick. Compact each lift as specified herein before placing the overlaying lift.
- C. Filling and Subgrade Preparation: Construct fill and embankment at the locations and to lines and grades indicated. Use only approved materials in constructing fill upon the prepared subgrade. Scarify the entire subgrade surface to a depth of 6 inches before the fill is started. Step, bench, or break up sloped surfaces steeper than one vertical to 4 horizontal so that the fill material will bond with or be securely keyed to the existing material. Scarify existing surface to a minimum depth of 6 inches if subgrade density is less than the degree of compaction specified and recompact. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 12 inches and recompact as specified for the adjacent fill. Place satisfactory material in horizontal lifts not exceeding 8 inches in loose depth and then compacted. Material will not be placed on surfaces that are

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muddy, frozen, or contain frost. Compact with equipment well suited to the soil being compacted. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each lift as specified herein before placing the overlaying lift.

TABLE 3.4.3

	Percent ASTM D 1557 Maximum Density	
	Cohesive Material	Cohesionless Material
Fill, Embankment and Backfill		
Under footings, building slabs, steps, and pavements	95	95
Under sidewalks and grassed areas	85	90
Adjacent to structures	90	95
Controlled fill	95	100

3.05 FINISH OPERATIONS

- A. Site Grading: Grade to finished grades indicated within 0.10 foot. Grade areas to drain water away from structures and to provide suitable surfaces for mowing machines. Existing grades which are to remain but are disturbed by the Contractor's operations shall be restored as specified herein.
- B. Finishing Subgrades Under Structures and Pavements: Finish the surface of the top lift of the fill or top of the subgrade to the elevation and cross section indicated. The finished surface shall be smooth and of uniform texture. Lightly scarify or blade the finished surface to bring the finished surface to within 0.05 foot of the indicated grade and to eliminate imprints made by compaction and shaping equipment. The surface shall show no deviations in excess of 3/8 inch when tested with a

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- 10 foot straightedge.
- C. Spreading Topsoil: Clear areas indicated to receive topsoil for the finished surface of materials interfering with planting and maintenance operations. Do not place topsoil when the subgrade is frozen, extremely wet or dry, or in other conditions detrimental to seeding, planting, or grading. Spread topsoil to a uniform depth of 4 inches over the designated area. Furnish vegetative cover as indicated or specified in Sections 02228, "Vegetative Cover".
 - D. Disposition of Surplus Material: Surplus or other soil material not required or suitable for filling, backfilling, or embankment shall be removed from Government property. Comply with the requirements of Section 01575 "Temporary Environmental Controls".
 - E. Protection of Surfaces: Protect newly graded areas from traffic, erosion, and settlements that may occur and as required in Section "Environmental Protection" and as defined in subparagraph "Protection and Restoration of Surfaces" of this section. Repair or reestablish damaged grades, elevations, or slopes prior to acceptance of work.

3.06 FIELD SAMPLING AND TESTING

- A. Samples: Submit one 50-pound composite sample for each material source of subgrade being compacted and fill material being placed. Submit samples, in the number directed, whenever the source or character of the embankment material changes. Contain each sample in a clean container and fasten to prevent loss of material. Tag each sample for identification. The tag shall contain the following information:

Contract No.
 Sample No.
 Date of Sample
 Sampler
 Source
 Intended Use

- B. Tests: Test fill in accordance with ASTM C 136 for conformance to ASTM C33, ASTM D 2419, and ASTM D

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2487 gradation limits. Test fill for material finer than the No. 200 sieve in accordance with ASTM D 1140. Test fill for liquid limit in accordance with ASTM D 4318 and for plasticity index in accordance with ASTM D 4318. Test fill materials for moisture density relations in accordance with ASTM D 1557. Perform one of each of the required tests for each material used when directed. Provide additional tests as specified above for each source change. Perform density tests in randomly selected locations and in accordance with ASTM D 1556, ASTM D 2922 and ASTM D 3017 as follows: One test per 2,500 square feet in each layer of lift and for each 1,000 square feet of subgrade in cut areas. Determine moisture content of soil material in place in accordance with ASTM D 3017 at every location where in-place density is tested. Where ASTM D 2922 and ASTM D 3017 is used to test field compaction densities, verify the results of the tests by performing at least one test per day using ASTM D 1556 at a location already tested by ASTM D 2922 and at least one additional test using ASTM D 1556 for every ten tests performed with a nuclear device, also at locations already checked by ASTM D 2922.

END OF SECTION

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SECTION 02.361 TERMITE CONTROL

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
1. Soil treatment with termiticide.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated. Include the EPA-Registered Label.
- B. Soil Treatment Application Report: Include the following:
1. Date and time of application.
 2. Moisture content of soil before application.
 3. Brand name and manufacturer of termiticide.
 4. Quantity of undiluted termiticide used.
 5. Dilutions, methods, volumes, and rates of application used.
 6. Areas of application.
 7. Water source for application.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.
- B. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label.

1.04 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
1. Warranty Period: **Five years** from date of Substantial Completion.

PART 2 PRODUCTS

2.01 SOIL TREATMENT

- A. Use an emulsible concentrate insecticide for dilution with water, specially formulated to prevent infestation by termites. Fuel oil will not be permitted as a diluent. Chemicals used must be acceptable to the Division of Forest Insect Research, Forest Service, U.S.D.A., or proprietary products registered with the Pesticide Regulation Section, Plant Pest Control Branch, Agricultural Research Service, U.S.D.A. under the Federal Insecticide and Rodenticide Act, for use as a termite toxicant for which prolonged effectiveness may be anticipated. In addition, the toxicant shall be EPA registered and suitable for use under the conditions indicated.
- B. Toxicant Chemical: Water based emulsion, uniform composition, synthetic dye to permit visual identification of treated soil.

PART 3 EXECUTION

3.01 PREPARATION

- A. General: Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

3.02 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 2. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers,; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
 - C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
 - D. Post warning signs in areas of application.
 - E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

SECTION 02475 AGGREGATE PIER FOUNDATION SYSTEM

PART 1 GENERAL REQUIREMENTS

1.01 Description: Work shall consist of furnishing and installing an Aggregate Pier foundation system to the lines and grades designated on the project drawings and as specified herein. The piers shall be constructed by either augering a shaft or driving a hollow mandrel to the design depth and vertically compacting lifts of aggregate or an aggregate/cement mixture using the specially designed densification equipment to create the compacted aggregate pier. The pier elements shall be in a columnar-type configuration and shall be used to produce an intermediate foundation system.

1.02 Work Included

- A. Provision of all equipment, material, labor, and supervision to design and install pier elements. Layout of pier elements, spoil removal, footing excavations, and subgrade preparation following aggregate pier installation is included.
- B. The Aggregate Pier design and installation shall adhere to all methods and standards described in this Specification.
- C. Drawings and General Provisions of the Contract, including General and Supplemental Conditions, and Division 1 Specifications, apply to the work in this specification.

1.03 Approved Installers

- A. The Pier Installer (the Installer) shall be approved by the Engineer prior to bid opening. Without exception, no alternate installer will be accepted unless approved by the Engineer at least two (2) weeks prior to bid opening.
- B. Installers of Aggregate Pier foundation systems shall have a minimum of 5 years of experience with the installation of Aggregate Pier systems and shall have completed at least 50 projects.

1.04 Reference Standards

- A. Modulus Testing
 - 1. ASTM D1143 - Pile Load Test Procedures
 - 2. ASTM D1194 - Spread Footing Load Test
 - 3. ASTM D7383-08 - Axial Compressive Force Pulse

(Rapid) testing of Deep Foundations (Statnamic Testing)

- B. Materials and Inspection
 - 1. ASTM D1241 - Aggregate Quality
 - 2. ASTM D422 - Gradation of Soils
 - 3. ASTM C31 Standard Practice for Making and Curing Cement Test Specimens in the field
 - 4. ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

1.05 Certifications and Submittals

- A. Design Submittal: The Installer shall submit detailed design calculations, construction drawings, and shop drawings, (the Design Submittal), for approval at least 2 weeks prior to the beginning of construction. A detailed explanation of the design parameters for settlement calculations shall be included in the Design Submittal. Additionally, the quality control test program for Aggregate Pier system, meeting these design requirements, shall be submitted. All computer-generated calculations and drawings shall be prepared and sealed by a Professional Engineer, licensed in the State of Mississippi.
- B. Modulus Test Reports: A modulus test(s) is performed on a non-production Rammed Aggregate Pier element and/or Rigid Inclusion Pier as required by the Pier Designer to verify the design assumptions. The Installer shall furnish installation records, test data, analysis of the test data and verification of the design parameter values based on the modulus test results. The report shall be prepared under direction of a Professional Engineer registered in the state of Mississippi.
- C. Daily Pier Progress Reports: The Installer shall furnish complete and accurate records of pier installation to the Engineer. The records shall indicate the pier location, length, volume of aggregate used or number of lifts, densification forces during installation, and final elevations or depths of the base and top of piers. The records shall also indicate the type and size of the installation equipment used, and the type of aggregate used and testing and material sampling that was performed. The Installer shall immediately report any unusual conditions encountered during installation to the Engineer and to the Testing Agency.

1.06 Aggregate Pier Design

- A. The design of the Aggregate Pier elements shall be based on the service load contact pressure and the allowable total and differential settlement criteria as indicated by the design team for support by the Aggregate Pier elements. Service loads are indicated on the drawings. The Aggregate Pier elements shall be designed in accordance with generally-accepted engineering practice and the methods described in Section 1 of these Specifications.
- B. The design shall meet the following criteria:
Minimum Allowable Bearing Pressure for 5000 psf
Footings supported by Aggregate Pier Reinforced Soils
Estimated Total Long-Term Settlement ≤ 1 -inch
Estimated Long-Term Differential Settlement $\leq \frac{1}{2}$ -inch
- C. The Aggregate Pier elements shall be designed and installed to completely penetrate existing or new fills where encountered.
- D. The Aggregate Pier elements shall be designed using an Aggregate Pier stiffness modulus to be verified by the results of the modulus test described in Section 3.05 of these specifications.

PART 2 MATERIALS

2.01 Aggregate

- A. Aggregate used by the Aggregate Pier Installer for pier construction shall be approved by the Engineer and shall demonstrate suitable performance during modulus testing. Typical aggregate consists of Type 1 Grade B in accordance with ASTM D-1241-68, No. 57 stone, recycled concrete, or other graded aggregate approved by the Engineer.
- B. Potable water or other suitable source shall be used to increase aggregate moisture content where required.

PART 3 EXECUTION

- 3.01 Approved Installation Procedures: The following sections provide general criteria for the construction of the Aggregate Pier elements. Unless otherwise approved by the Engineer, the installation method used for pier construction shall be that as used in the construction of the successful modulus test.

- A. Augered Aggregate Pier:
 - 1. Augered Aggregate Pier system shall be pre-augered using mechanical drilling or excavation equipment.
 - 2. If cave-ins exceeding 10 percent of the lift volume occur during excavation such that the sidewalls of the hole are deemed to be unstable, steel casing shall be used to stabilize the shaft or a displacement Aggregate Pier system may be used.
 - 3. Aggregate shall be placed in the augered cavity in lift thicknesses as determined by the Rammed Aggregate Pier Designer and approved by the Engineer.
 - 4. A specially-designed beveled tamper and high-energy impact densification apparatus shall be employed to densify lifts of aggregate during installation. The apparatus shall apply direct downward impact energy to each lift of aggregate. Compaction equipment that induces horizontal vibratory energy is not permitted.
- B. Displacement Aggregate Pier:
 - 1. Displacement Aggregate Pier systems shall be constructed by advancing a specially designed mandrel with a minimum 15 ton static force augmented by dynamic vertical ramming energy to the full design depth. The hollow-shaft mandrel, filled with aggregate, shall be incrementally raised, permitting the aggregate to be released into the shaft, and then lowered by vertically advancing and/or ramming to densify the aggregate and force it laterally into the adjacent soil. The cycle of raising and lowering the mandrel is repeated to the top of pier elevation. The cycle distance shall be determined by the Engineer.
 - 2. Special high-energy impact densification apparatus shall be employed to vertically densify the Aggregate Pier elements during installation of each constructed lift of aggregate.
 - 3. Densification shall be performed using a mandrel /tamper. The mandrel/tamper foot is required to adequately increase the lateral earth pressure in the matrix soil during installation. Compaction equipment that induces horizontal vibratory energy is not permitted.
 - 4. Downward crowd pressure shall be applied to the mandrel during installation.
 - 5. For Aggregate pier elements using #57 stone and neat

cement or sand cement grout mixtures a minimum of 3 cylinders shall be taken daily in accordance with ASTM C31 to perform compressive strength testing of the stone/cement mixture to show it is in accordance with the project strength requirements.

3.02 Plan Location and Elevation of Pier Elements

The as-built center of each pier shall be within 6 inches of the locations indicated on the plans. Piers installed outside of the above tolerances and deemed not acceptable shall be rebuilt at no additional expense to the Owner.

3.03 Rejected Pier Elements

Pier elements installed beyond the maximum allowable tolerances shall be abandoned and replaced with new piers, unless the Designer approves the condition or provides other remedial measures. All material and labor required to replace rejected piers shall be provided at no additional cost to the Owner, unless the cause of rejection is due to an obstruction or mislocation.

3.04 Quality Control Technician

The Installer shall have a full-time, on-site Quality Control Technician to verify and report all installation procedures. The Installer shall immediately report any unusual conditions encountered during installation to the Engineer, the General Contractor, and to the Testing Agency.

3.05 Aggregate Pier Modulus and Rigid Inclusion Load Testing

As required, Aggregate Pier Modulus Test(s) will be performed at locations directed by the Engineer and the Testing Agency to verify or modify Aggregate Pier. Test Procedures shall utilize appropriate portions of ASTM D 1143, ASTM D 1194, or ASTM D7383-08 as outlined in the design submittal.

3.06 Bottom Stabilization Testing (BSTs)/Crowd Stabilization

Testing (CSTs) Bottom stabilization testing (BSTs) or Crowd stabilization testing (CSTs) shall be performed by the Control Technician during the installation of the modulus test pier. Additional testing as required by the Engineer shall be performed on selected production Pier elements to compare results with the modulus or load test pier.

3.07 Independent Engineering Testing Agency

A. The Testing Agency shall monitor the modulus test pier installation and testing. The Installer shall provide and install all dial indicators and other measuring devices.

B. The Testing Agency shall monitor the installation of

Pier elements to verify that the production installation practices are similar to those used during the installation of the modulus test elements.

- C. The Testing Agency shall report any discrepancies to the Installer and General Contractor immediately.
- D. The Testing Agency shall observe the excavation, compaction and placement of the foundations as described in Section 3.09. Dynamic Cone Penetration testing may be performed to evaluate the footing bottom condition as determined by the Testing Agency

3.08 Excavations of Obstructions

- A. Should any obstruction be encountered during Pier installation, it shall be promptly removed. Obstructions include, but are not limited to, boulders, timbers, concrete, bricks, utility lines, etc., which shall prevent placing the piers to the required depth, or shall cause the pier to drift from the required location.

3.09 Footing Bottoms

- A. Excavation and surface compaction of all footings shall be the responsibility of the General Contractor.
- B. Foundation excavations to expose the tops of Pier elements shall be made in a workman-like manner, and shall be protected until concrete placement, with procedures and equipment best suited to (1) avoid exposure to water, (2) prevent softening of the matrix soil between and around the Aggregate Pier elements before pouring structural concrete, and (3) achieve direct and firm contact between the dense, undisturbed Aggregate Pier elements and the concrete footing.
- C. All excavations for footing bottoms supported by Aggregate Pier foundations shall be prepared in the following manner by the General Contractor. Recommended procedures for achieving these goals are to:
 - 1. Limit over-excavation below the bottom of the footing to 3-inches (including disturbance from the teeth of the excavation equipment).
 - 2. Compaction of surface soil and top of Aggregate Pier elements shall be prepared using a motorized impact compactor ("Wacker Packer," "Jumping Jack," or similar). Sled-type tamping devices shall only be used in granular soils and when approved by the designer. Loose or soft surficial soil over the entire footing bottom shall be re-compacted or

removed, respectively. The surface of the aggregate pier shall be re-compacted prior to completing footing bottom preparation.

3. Place footing concrete immediately after footing excavation is made and approved, preferably the same day as the excavation. Footing concrete must be placed on the same day if the footing is bearing on moisture-sensitive soils. If same day placement of footing concrete is not possible, open excavations shall be protected from surface water accumulation. A lean concrete mud-mat may be used to accomplish this. Other methods must be pre-approved by the Engineer.
- D. The following criteria shall apply, and a written inspection report sealed by the project Testing Agency shall be furnished to the Installer to confirm:
1. That water (which may soften the unconfined matrix soil between and around the Aggregate Pier elements, and may have detrimental effects on the supporting capability of the Aggregate Pier reinforced subgrade) has not been allowed to pond in the footing excavation at any time.
 2. That all Aggregate Pier elements designed for each footing have been exposed in the footing excavation.
 3. That immediately before footing construction, the tops of Aggregate Pier elements exposed in each footing excavation have been inspected and recompactd as necessary with mechanical compaction equipment.
 4. That no excavations or drilled shafts (elevator, etc.) have been made after installation of Aggregate Pier elements within the excavation limits described in the Aggregate Pier construction drawings, without the written approval of the Engineer.
- E. Failure to provide the above inspection and certification by the Testing Agency, which is beyond the responsibility of the Pier Installer, may void any written or implied warranty on the performance of the Aggregate Pier.

END OF SECTION

SECTION 02510 BITUMINOUS PAVING AND BASE COURSE (ALTERNATE)

PART 1 GENERAL

1.01 REFERENCES

- A. 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.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 131	1989 Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	1984 (Rev. A) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 242	1985 (R 1990) Mineral Filler for Bituminous Paving Mixtures
ASTM D 422	1963 (R 1990) Particle-Size Analysis of Soils
ASTM D 692	1988 Coarse Aggregate for Bituminous Paving Mixtures
ASTM D 977	1991 Emulsified Asphalt
ASTM D 1073	1988 Fine Aggregate for Bituminous Paving Mixtures
ASTM D 1188	1989 Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
ASTM D 1559	1989 Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
ASTM D 2028	1976 (R 1986) Cutback Asphalt (Rapid-Curing Type)

ASTM D 3381 1983 Viscosity-Graded Asphalt Cement
for Use in Pavement Construction

MISSISSIPPI DEPARTMENT OF TRANSPORTATION (DOT)

DOT SS-1 Road and Bridge Construction, 1990 with
Supplement thereto dated 1991

MILITARY STANDARDS (MIL-STD)

MIL-STD-620 Rev. A) (Notice 1) Bituminous Paving
Materials

1.02 SUBMITTALS

A. Submit the following:

1. Design Data: Job-mix formula
 - a. Job Mix Formula: Submit for each mix and each change in mix or materials as prepared by an approved testing laboratory, including data outlined in paragraph entitled "Asphaltic Concrete Wearing Course." The job-mix formula shall be submitted for approval and shall include the specific gravities of aggregates and bitumen.
2. Factory Test Reports:
 - a. Asphaltic concrete wearing and base courses.
 - b. Subbase: Provide sieve analysis and Proctor Density (ASTM D1557).
Submit, from an approved testing laboratory. Show that the asphaltic concrete produced daily complies with the approved job-mix formula. Either full time plant inspection or periodic checks shall be acceptable.
3. Certificates - Bituminous prime and tack coat materials: Submit for each shipment.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Subbase Course: Crushed limestone base course shall consist of a blend of various sizes of 100% crushed limestone or granite, containing not more than 20% thin or elongated pieces. Percentage of wear, Los Angeles Test, shall not be more than 50%. When subjected to five (5) cycles of the soundness test, by

use of magnesium sulfate, the weighted percentage of loss shall not be more than 15. The blend shall be well-graded to permit an easy compaction into a stable mass, and shall conform in every case to the following master range:

<u>Square-Mesh Sieve</u>	<u>% Passing (By Dry Wt).</u>
1 1/2"	100
1"	90 - 100
3/4"	70 - 95
3/8"	50 - 80
#4	35 - 65
#10	25 - 50
#40	10 - 26
#200	4 - 12

B. Asphaltic Concrete Wearing Course: Hot-mixed and hot-laid asphaltic concrete of compacted thickness indicated. The materials when used shall conform to the following:

1. Coarse Aggregate (Maximum Los Angeles Abrasion Loss 40 percent): ASTM D 692, except as modified herein.
2. Fine Aggregate: ASTM D 1073, except as modified herein.
3. Mineral Filler: ASTM D 242.
4. Asphalt Cement: ASTM D 3381, viscosity Grade AC-30.
 - a. Mix: Produce mix in an approved plant from an approved job-mix formula based on the following:
 - (1) Gradation:

SIEVE	PERCENT PASSING
1-inch	100
3/4-inch	90 - 100
1/2-inch	---
3/8-inch	56 - 80
No. 4	35 - 65
No. 8	23 - 49
No. 50	5 - 19
No. 200	2 - 8

- b. Bituminous Content: 5.5 to 8.5 percent in accordance with approved job-mix formula.
 - c. Physical Properties: The mixture shall have the following physical properties:
 - (1) Stability: Not less than 1000 pounds
 - (2) Flow: Not more than 0.20-inch or less than 0.08-inch
 - (3) Percent Total Voids: Not less than 3 nor more than 5
 - (4) Percent Voids Filled with Asphalt: Not less than 75 nor more than 85
 - d. Determination of Physical Properties: The above physical properties shall be determined in accordance with MIL-STD-620, modified as follow:
 - (1) Seventy-five blows of the hammer shall be applied to each flat face of the specimen.
 - (2) Temperature of the mixture immediately prior to compaction shall be 250 degrees F plus or minus 10 degrees.
 - (3) The head of the hammer and the molds used in preparing the specimens shall be at a temperature of approximately 250 degrees F.
 - (4) After compaction, the specimens used for determination of specific gravity shall be air-cooled to approximately the same temperature as the water to be used.
- C. Contractor's Option for Wearing Course Materials Only: At the option of the Contractor, those applicable material sections of the Mississippi Department of Transportation DOT SS-1 for Bituminous Plant Mix, Section 403, Design Master Range SC-1, shall govern in lieu of this specification for asphaltic concrete wearing course. Do not change the selected option during the course of the work.
- D. Asphaltic Concrete Base Course: Hot plant-mixed and hot laid and average at least the compacted thickness indicated, not varying from the required amount by more than one-half inch at any point. Construct base in layers not more than 3 inches thick when compacted on prepared subgrade, as indicated. Protect preceding layers of asphaltic concrete base from traffic and

lightly scarify to make proper bond with succeeding layers or apply tack coat as directed by the Owner's Representative. Materials shall conform to the following:

1. Asphalt: ASTM D 3381, viscosity Grade AC-30.
2. Coarse Aggregate: ASTM D 692.
3. Fine Aggregate: ASTM D 1073.
4. Gradation:

SIEVE	PERCENT PASSING
1 1/2-inch	100
1-inch	80 - 100
3/4-inch	---
1/2-inch	60 - 100
3/8-inch	---
No.4	34 - 75
No.10	24 - 60
No.40	10 - 44
No.80	4 - 26
No.200	3 - 14

Asphalt content shall be between 4 and 8 percent by weight and shall be based on an approved job-mix formula. Mixture shall be uniform and homogeneous and shall have a stability of not less than 1400 pounds and a flow of not more than 0.20-inch when tested in accordance with ASTM D 1559, with the following modifications:

1. Seventy-five blows of the hammer shall be applied to each flat face of the specimen.
2. Temperature of the mixture immediately prior to compaction shall be 250 degrees F plus or minus 10 degrees.
3. Head of the hammer and the molds used in preparing the specimens shall be at a temperature of approximately 250 degrees F.
4. After compaction, the specimens used for determination of specific gravity shall be air-cooled to approximately the same temperature as the water to be used.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Construction of Crushed Stone Subbase Course:
Construct to meet requirements of MDOT Specification Section 304 as applicable.
1. Crushed limestone mixture shall be placed upon the prepared subgrade and shall be compacted and graded to form a usable temporary road surface. This surface shall be maintained by grading, watering, additional crushed limestone mixture and additional compaction as necessary to maintain local traffic until the asphalt base course is installed. If necessary to avoid stratification of the subbase course, the additional crushed limestone mixture shall be blended into the in-place material by scarifying or other approved means.
 2. Compaction shall be promptly after satisfactory spreading of the subbase material and while moisture content is at optimum. The Contractor shall use pneumatic tired rollers, steel wheel rollers, vibratory rollers, tampers, sprinkling equipment, etc., as required to compact the base material to 95% Modified Proctor density.
 3. Where the density of any layer of the base material fails to meet the specified density, the Contractor will be permitted to first apply more compactive effort or utilize other approved methods of obtaining the required density. If the density cannot be obtained by such efforts, the material for the full depth of the layer of the affected area shall be removed and replaced with new material, at no additional compensation.
- B. Asphalt Prime: Prime finished base course with MC-70 EAP or EA1, as applicable. Apply at a rate that base will absorb in a 24 hour period. Spread sand onto completed prime as may be necessary to permit passage of construction and or paving equipment.
- C. Bituminous Tack Coat: Apply not more than 0.12 gallon per square yard nor less than 0.08 gallon per square yard of liquid asphalt or asphalt emulsion to the existing asphalt pavement. Cutback asphalt shall conform to the requirements of ASTM D 2028, Designation RC-70 or RC-250. Asphalt emulsion shall meet the requirements of ASTM D 977, Designation SS-

- 1; if used, emulsion may be diluted with not more than 50 percent water. Apply 0.10 gallon per square yard of net bitumen to the entire primed base course.
- D. Spreading and Compacting of Asphaltic Concrete Wearing and Base Courses: Spread wearing course with a bituminous spreader at a temperature of not less than 250 degrees F nor more than 300 degrees F. Roll, while hot, with a steel-wheel roller weighing not less than 10 tons and a pneumatic-tired roller to a density of at least 96 percent of that attained in a laboratory specimen of the same mixture prepared in accordance with MIL-STD-620, Method 100. Determine density of in-place material from the bulk specific gravity obtained in accordance with the requirements of ASTM D 1188. In areas where the use of machine-spreading is impractical, spread the mixture by hand. Dump mixture on approved dump boards or on adjacent approved area outside the area to be paved and distribute into place from the dump boards or from the approved area by means of hot shovels. Spread mixture with hot rakes in a uniformly loose layer of a thickness that when compacted will conform to the required grade and thickness. During hand spreading, carefully place each shovelful of mixture by turning the shovel over in a manner that will prevent segregation. In no case shall mixture be placed by throwing or broadcasting from a shovel. Do not dump the loads any faster than can be properly handled by the shovelers and rakers. Finished surface shall not vary more than 1/8-inch when tested with a 10-foot straightedge. The finished thickness shall not vary more than 1/4-inch from required thickness at any point and average thickness of depth measurements shall be at least the thickness indicated. Areas not meeting the above requirements will be rejected until corrected by the Contractor.

3.02 FIELD QUALITY CONTROL

- A. Where required for testing of density and thickness, cores shall be extracted, tested, and pavement replaced by the Contractor.
- B. Testing: Perform the following tests:
1. Sieve Analysis: ASTM C 136, composite and each blend.
 2. Particle Size Analysis: ASTM D 422, composite and blend.

3. CBR: Composite.
4. Los Angeles Abrasion: ASTM C 131.
5. Maximum Density Determination: Composite.
6. Liquid Limit and Plasticity Index: Composite and each blend.
7. Percentage of each material in blend or stabilization. Generally, one of each test from each source and each change in material or blend is required.
8. Surface Tests: Test completed base and wearing courses for uniformity in grade as specified hereinbefore by using a 10 foot straightedge.
9. In-place Density and Thickness: Make at least one density and thickness test for each 200 square yards of wearing course.

END OF SECTION

SECTION 02530 CAST-IN-PLACE CONCRETE FOR
SITE WORK - SIDEWALK AND HEAVY DUTY PAVING

PART 1 - GENERAL

1.01 SCOPE

- A. The CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to provide cast-in-place concrete as shown and specified. The Work includes providing concrete consisting of portland cement, fine and coarse aggregate, water, and approved admixtures; combined, mixed, transported, placed, finished and cured.

1.02 QUALITY ASSURANCE

- A. Comply with the applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ACI 301, Specification for Structural Concrete for Buildings, (includes ASTM Standards referred to herein).
 2. ACI 38, Building Code Requirements for Reinforced Concrete.
 3. ACI 304, Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
 4. ACI 311, Recommended Practice for Concrete Inspection.
 5. ACI 211.1, Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete.
 6. ACI 214, Recommended Practice for Evaluation of Compression Test Results of Field Concrete.
 7. ACI 305, Recommended Practice for Hot Weather Concreting.
 8. ACI 306, Recommended Practice for Cold Weather Concreting.
 9. ACI 309, Recommended Practice for Consolidation of Concrete.
 10. AASHTO M 182, Burlap Cloth Made From Jute or Kenaf.
- B. CONTRACTOR shall employ, at his own expense, a testing laboratory experienced in design and testing of concrete materials and mixes to perform material evaluation tests and to design concrete mixes.
1. Testing agency shall meet the requirements of ASTM E 329.
 2. Selection of a testing laboratory is subject to the ENGINEER's approval.
 3. Submit a written description of the proposed concrete testing laboratory giving qualifications of personnel, laboratory facilities and equipment, and other information which may be requested by the ENGINEER.

Materials and installed Work may require testing and retesting, as directed by the ENGINEER, at any time during the progress of the Work. Allow free access to material stockpiles and facilities at all times. Tests not specifically indicated to be done at the OWNER's expense, including the retesting of rejected materials and installed Work, shall be done at the CONTRACTOR's expense.

- C. Submit written reports to the ENGINEER, for each material sampled and tested, prior to the start of Work. Provide the Project identification name and number, date of report, name of CONTRACTOR, name of concrete testing service, source of concrete aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.

1.03 SUBMITTALS

- A. Samples: Submit samples of materials as specified and as otherwise may be requested by the ENGINEER, including names, sources and descriptions.
- B. Shop Drawings: Submit for approval the following:
 - 1. List of concrete materials and concrete mix designs proposed for use. Include the results of all tests performed to qualify the materials and to establish the mix designs.
 - 2. Copies of manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.
- C. Laboratory Test Reports: Submit copies of laboratory test reports for concrete cylinders, materials and mix design tests. ENGINEER's review will be for general information only. Production of concrete to comply with specified requirements is the responsibility of the CONTRACTOR.
- D. Submit notarized certification of conformance to referenced standards when requested by the ENGINEER.
- E. Delivery Tickets: Furnish to ENGINEER copies of all delivery tickets for each load of concrete delivered to the site. Provide items of information as specified in ASTM C 94, Section 14.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All materials used for concrete must be kept clean and free from all foreign matter during transportation and handling and kept separate until measured and placed in the mixer. Bins or platforms having hard clean surfaces shall be provided for storage. Suitable means shall be taken during hauling, piling and handling to insure that segregation of the coarse and

fine aggregate particles does not occur and the grading is not affected.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement:

1. Portland cement, ASTM C 150, Type II; or blended hydraulic cement, ASTM C 595, Type Lp. Type I may be used in lieu of Type II when acceptable to ENGINEER.
2. Use portland cement made by a well known acceptable manufacturer and produced by not more than one plant.
3. Do not use cement which has deteriorated because of improper storage or handling.

B. Aggregates: ASTM C 33 and as herein specified.

1. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, ocher, or other materials that can cause stains on exposed concrete surfaces.
2. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances. Dune sand, bank run sand and manufactured sand are not acceptable.
3. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
 - a. Crushed stone processed from natural rock or stone;
 - b. Washed gravel, either natural or crushed. Use of slag and pit or bank run gravel is not permitted.
 - c. Coarse Aggregate Size: Size to be ASTM C 33, Nos. 57 or 67.

C. Water: Clean, free from injurious amounts of oils, acids, alkalis, organic materials or other substances that may be deleterious to concrete or steel.

D. Provide only admixtures which have been incorporated and tested in the accepted mixes. Air-entraining admixtures shall comply with ASTM C 260. Water reducing admixtures shall comply with the requirements of ASTM C 494, Type A. The use of calcium chloride in concrete mixes is not permitted.

E. Classes of Concrete:

1. Class "A" concrete shall be steel reinforced and includes the following:
 - a. Foundations
 - b. Walls
 - c. Slabs
2. Class "B" concrete shall be placed without forms or with simple forms, with little or no reinforcing, and includes the following:

- a. Concrete fill
- b. Equipment bases
- c. Pipe supports
- d. Thrust blocks
- e. Encasements

2.02 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes of concrete. Use the same design mix for both classes of concrete. Mixes subject to the following limitations:
 - 1. Specified 28-day Compressive Strength: 3,500 psi - Wall Footings and Sidewalks; 4,000 psi - 6" Thick Heavy Duty Paving; 5,000 psi - 8" and 12" Thick Heavy Duty Paving.
 - 2. Maximum Water-Cement Ratio by Weight: 0.45.
- B. Use an independent testing facility acceptable to the ENGINEER for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.
- C. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the Project for concrete required. Comply with ACI 211.1 and report to the ENGINEER the following data.
 - 1. Complete identification of aggregate source of supply.
 - 2. Tests of aggregates for compliance with specified requirements.
 - 3. Scale weight of each aggregate.
 - 4. Absorbed water in each aggregate.
 - 5. Brand, type and composition of cement.
 - 6. Brand, type and amount of each admixture.
 - 7. Amounts of water used in trial mixes.
 - 8. Proportions of each material per cubic yard.
 - 9. Gross weight and yield per cubic yard of trial mixtures.
 - 10. Measured slump.
 - 11. Measured air content.
 - 12. Compressive strength developed at 7 days and 28 days, from not less than 3 test cylinders cast for each 7-day and 28-day test, and for each design mix.
- D. Submit written reports to the ENGINEER of proposed mix of concrete at least 15 days prior to start of Work. Do not begin concrete production until mixes have been approved by the ENGINEER.
- E. Laboratory Trial Batches: When laboratory trial batches are used to select concrete proportions, prepare test specimens and conduct strength tests as specified in ACI 301, Chapter 3 - Proportioning, Method 1.
- F. Field Experience Method: When field experience methods are used to select concrete proportions,

establish proportions as specified in ACI 301, Chapter 3, Method 2.

- G. Water-Cement Ratio Methods: If suitable data from field experience or laboratory trial batches cannot be obtained, concrete proportions may be established as specified in ACI 301, Chapter 3, Method 3.
- H. Adjustment to Concrete Mixes: Mix design adjustments may be requested by CONTRACTOR when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to the OWNER and as accepted by ENGINEER. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by ENGINEER before using the revised mixes.
- I. Admixtures:
 - 1. Use air-entraining admixture in all concrete, except interior slabs subject to abrasion, unless otherwise shown or specified. Add air-entraining admixture at the manufacturer's prescribed rate to result in concrete at the point of placement having air content within the prescribed limits.
 - 2. Use amounts of admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities and types of admixtures as required to maintain quality control.
- J. Slump Limits:
 - 1. Proportion and design mixes to result in concrete slump at the point of placement of not more than 4 inches.

2.03 CONCRETE CURING MATERIALS

- A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 10 ounces per square yard and complying with AASHTO M 182, Class 3.
- B. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
 - 1. Waterproof paper.
 - 2. Polyethylene film.
 - 3. White burlap-polyethylene sheet.
- C. Curing and Sealing Compound: Federal Spec TT C-800A, 30 percent solids content minimum. A chlorinated rubber or acrylic compound.
 - 1. Product and Manufacturer: Provide one of the following:
 - a. Super Floor Coat or Super Pliocure by The Euclid Chemical Company.
 - b. Masterseal by Master Builders Company.

2.04 CONCRETE JOINTING MATERIALS

- A. Filler: Joint filler shall be ½" for sidewalks and ¾" for heavy duty paving. Material shall be preformed asphalt expansion joint material conforming to ASTM

D994 or ASTM D1751, or closed cell poly foam (expanded polyethylene) conforming to A.S.T.M. D1752, Sections 3.1 through 3.4.

- B. Sealants: Sealants shall be Dow Corning 890-SL silicone self-leveling sealant or approved equal.

PART 3 - EXECUTION

3.01 CONCRETE MIXING

- A. Concrete may be produced at batch plants or it may be produced by the ready-mixed process. Batch plants shall comply with the recommendations of ACI 304, and shall have sufficient capacity to produce concrete of the qualities specified, in quantities required to meet the construction schedule. All plant facilities are subject to testing laboratory inspection and acceptance of the ENGINEER.
- B. Mixing:
 - 1. Mix concrete with an approved rotating type batch machine, except where hand mixing of very small quantities may be permitted.
 - 2. Remove hardened accumulations of cement and concrete frequently from drum and blades to assure acceptable mixing action.
 - 3. Replace mixer blades when they have lost 10 percent of their original height.
 - 4. Use quantities such that a whole number of bags of cement is required, unless otherwise permitted.
 - 5. Job Site Mixing: Not permitted.
- C. Ready-Mix Concrete:
 - 1. Comply with the requirements of ASTM C 94, and as herein specified, must be accepted by the ENGINEER before implementation.
 - a. Plant equipment and facilities: Conform to National Ready-Mix Concrete Association "Plant and Delivery Equipment Specification".
 - b. Mix concrete in revolving type truck mixers which are in good condition and which produce thoroughly mixed concrete of the specified consistency and strength.
 - c. Do not exceed the proper capacity of the mixer.
 - d. Mix concrete for a minimum of two minutes after arrival at the job site, or as recommended by the mixer manufacturer.
 - e. Do not allow the drum to mix while in transit.
 - f. Mix at proper speed until concrete is discharged.
 - g. Maintain adequate facilities at the job site for continuous delivery of concrete at the

- required rates.
- h. Provide access to the mixing plant for the ENGINEER at all times.
- D. Maintain equipment in proper operating condition, with drums cleaned before charging each batch. Schedule rates of delivery in order to prevent delay of placing the concrete after mixing, or holding dry-mixed materials too long in the mixer before the addition of water and admixtures.

3.02 TRANSPORTING CONCRETE

- A. Transport and place concrete not more than 45 minutes after water has been added to the dry ingredients.
- B. Take care to avoid spilling and separation of the mixture during transportation.
- C. Do not place concrete in which the ingredients have been separated.
- D. Do not re-temper partially set concrete.
- E. Use suitable and approved equipment for transporting concrete from mixer to forms.

3.03 CONCRETE PLACEMENT

- A. General: Place concrete continuously so that no concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as specified in Section 03300 of these specifications. Deposit concrete as nearly as practical in its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure which will cause segregation.
 - 1. Screed concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.
 - 2. Do not use concrete which becomes non-plastic and unworkable, does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use re-tempered concrete. Remove rejected concrete from the job site and dispose of it in an approved location.
 - 3. Do not place concrete until all forms, bracing, reinforcement, and embedded items are in final and secure position.
 - 4. Do not place footings in freezing weather unless adequate precautions are taken against frost action.
 - 5. Do not place footings, piers or pile caps on frozen soil.
 - 6. Unless otherwise approved, place concrete only when Testing Agency is present.
 - 7. Allow a minimum of 7 days before placing concrete against a slab or wall already in place.

- B. Concrete Conveying:
1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practical by methods which will prevent segregation and loss of concrete mix materials.
 2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice and other deleterious materials.
 3. Do not use chutes for distributing concrete unless approved in writing by the ENGINEER.
 - a. Provide sketches showing methods by which chutes will be employed where requesting such approval.
 - b. Design chutes, if permitted, with proper slopes and supports to permit efficient handling of the concrete.
 4. Do not pump concrete unless permitted by the ENGINEER, and, if permitted, do not use aluminum piping.
- C. Placing Concrete Into Forms:
1. Deposit concrete in forms in horizontal layers not deeper than 18 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place concrete at such a rate that concrete which is being integrated with fresh concrete is still plastic.
 2. Do not permit concrete to free fall within the form from a distance exceeding 4 feet. Use "elephant trunks" to prevent free fall and excessive splashing on forms and reinforcement.
 3. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.
 4. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with the applicable recommended practices of ACI 309. Vibration of forms and reinforcing will not be permitted, unless otherwise accepted by the ENGINEER.
 5. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not

farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete and at least 6 inches into the preceding layer. Do not insert vibrator into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

6. Force concrete under pipes, sleeves, openings and inserts from one side until visible from the other side to prevent voids.

D. Placing Concrete Slabs:

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is complete.
2. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Bring slab surfaces to the correct level. Smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

E. Bonding for Next Concrete Pour: Roughen surfaces of set concrete at all joints, except where bonding is obtained by use of a concrete bonding agent. Clean surfaces of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly and do not leave laitance, loose particles of aggregate, or damaged concrete at the surface. Prepare for bonding of fresh concrete to new concrete that has set but is not fully cured, as follows:

1. Thoroughly wet the surface but allow no free standing water.
2. For horizontal surfaces place a 2-inch layer of mortar, 1 part sand and 1 part cement with water, over the hardened concrete surface.
3. Place fresh concrete before the mortar has attained its initial set.

F. Quality of Concrete Work:

1. Make all concrete solid, compact and smooth, and free of laitance, cracks and cold joints.
2. All concrete for liquid retaining structures, and all concrete in contact with earth, water, or exposed directly to the elements shall be watertight.
3. Cut out and properly replace to the extent

ordered by the ENGINEER, or repair to the satisfaction of the ENGINEER, surfaces which contain cracks or voids, are unduly rough, or are in any way defective. Thin patches or plastering will not be acceptable.

4. All leaks through concrete, and cracks, holes or other defective concrete in areas of potential leakage, shall be repaired and made watertight by the CONTRACTOR.
5. Repair, removal, and replacement of defective concrete as ordered by the ENGINEER shall be at no additional cost to the OWNER.

G. Cold Weather Placing:

1. Protect all concrete Work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306 and as herein specified.
2. When the air temperature has fallen to or may be expected to fall below 40 degrees F, provide adequate means to maintain the temperature, in the area where concrete is being placed, at between 50 degrees F and 70 degrees F for at least seven days after placing. Provide temporary housings or coverings including tarpaulins or plastic film. Maintain the heat and protection, if necessary, to insure that the ambient temperature does not fall more than 30 degrees F in the 24 hours following the seven-day period. Avoid rapid dry-out of concrete due to overheating, and avoid thermal shock due to sudden cooling or heating.
3. When air temperature has fallen to or is expected to fall below 40 degrees F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 55 degrees F and not more than 85 degrees F at point of placement.
4. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel, and adjacent concrete surfaces are entirely free of frost, snow and ice before placing concrete.
5. Do not use salt and other materials containing antifreeze agents or chemical accelerators, or set-control admixtures, unless approved by the ENGINEER, in mix designs.

H. Hot Weather Placing:

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 80 degrees F when the temperature is rising and below 85 degrees F when the temperature is falling. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated in the total amount of mixing water.
3. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
4. Wet forms thoroughly before placing concrete.
5. Do not place concrete at a temperature so as to cause difficulty from loss of slump, flash set, or cold joints.
6. Do not use set-control admixtures unless approved by the ENGINEER in mix designs.
7. Obtain ENGINEER's approval of other methods and materials proposed for use.

3.04 FINISH OF FORMED SURFACES

- A. After placing concrete slabs, do not work the surface further until ready for floating when the surface water has disappeared or when the concrete has stiffened sufficiently. Use a wood float only. Check and level the surface plane to a tolerance not exceeding $\frac{1}{4}$ inch in 10 feet when tested with a 10 foot straight edge placed on the surface at not less than 2 different angles. Cut down high spots and fill all low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.
- B. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface. Consolidate the concrete surface by the final hand troweling operation. Finish shall be free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding $\frac{1}{8}$ inch in 10 feet when tested with a 10 foot straight edge. Grind smooth surface defects which would telegraph through applied floor covering system. Use the trowel finish for all interior exposed slabs. Provide a sealing compound on all exposed slabs, bases, and supports.

3.05 CONCRETE CURING AND PROTECTION

- A. General:
 1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and

maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.

2. Start initial curing after placing and finishing concrete as soon as free moisture has disappeared from the concrete surface. Keep continuously moist for not less than 72 hours.
3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301 procedures.

B. Curing Methods:

1. Perform curing of concrete by moist curing, or by moisture retaining cover curing, by curing compound, or by combinations thereof, as herein specified. For curing, use water that is free of impurities which could etch or discolor exposed, natural concrete surfaces.
2. Provide moisture curing by any of the following methods:
 - a. Keeping the surface of the concrete continuously wet by covering with water.
 - b. Continuous water-fog spray.
 - c. Covering the concrete surface with the specified absorptive cover, thoroughly saturating the cover with water, and keeping the absorptive cover continuously wet with sprinklers or porous hoses. Place absorptive cover so as to provide coverage of the concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.
3. Provide moisture retaining cover curing by covering the concrete surfaces with the specified moisture-retaining cover for curing concrete, placed in the widest practical width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during the curing period using cover material and waterproof tape.
4. Provide liquid curing compound by applying the specified curing and sealing compound to all slabs with carpet, with resilient tile or left exposed. Apply the specified curing and hardening compound to all other interior slabs and tank bases that are to receive grout topping. The compounds shall be applied immediately after final finishing in a continuous operation by power spray equipment in accordance with the manufacturer's directions. Re-coat areas which are subject to heavy rainfall within 3 hours after initial application. Maintain the continuity of the coating and repair damage to

the coat during the entire curing period. For concrete surfaces which will be in contact with potable water, the manufacturer shall certify that the curing compound used is non-toxic.

- C. Temperature of Concrete During Curing:
 - 1. When the atmospheric temperature is 40 degrees F and below, maintain the concrete temperature between 50 degrees F and 70 degrees F continuously throughout the curing period. When necessary, make arrangements before concrete placing for heating, covering, insulation or housing as required to maintain the specified temperature and moisture conditions continuously for the concrete curing period. Provide cold weather protection complying with the requirements of ACI 306.
 - 2. When the atmospheric temperature is 80 degrees F and above or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation of wind breaks or shading, and for fog spraying, wet sprinkling, or moisture retaining covering. Protect the concrete continuously for the concrete curing period. Provide hot weather protection complying with the requirements of ACI 305, unless otherwise specified.
 - 3. Maintain concrete temperature as uniformly as possible, and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete which exceed 5 degrees F in any 24 hour period.
- D. Protection from Mechanical Injury:
 - 1. During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.06 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction:
 - 1. Sampling and testing for field quality control during the placement of concrete:
 - a. Sampling Fresh Concrete: ASTM C 172.
 - b. Slump: ASTM C 143; one test for each concrete load at point of discharge; and one for each set of compressive strength test specimens.
 - c. Air Content: ASTM C 231; one for every other concrete load at point of discharge, or when required by an indication of change.

- d. Compressive Strength Tests: ASTM C39; one set of compression cylinders for each 50 cubic yards or fraction thereof, of each mix design placed in any one day or for each 2,500 square feet of surface area placed; 1 specimen tested at 7 days, and 2 specimen tested at 28 days.
 - (1) Adjust mix if test results are unsatisfactory and resubmit for ENGINEER's approval.
 - (2) Concrete which does not meet the strength requirements is subject to rejection and removal from the Work, or to other such corrective measures as directed by the ENGINEER, at the expense of the CONTRACTOR.
 - e. Compression Test Specimens: ASTM C31; make one set of 3 standard cylinders for each compressive strength test, unless otherwise directed. Cast, store and cure specimens as specified in ASTM C31.
 - f. Concrete Temperature: Test hourly when air temperature is 40 degrees F and below, and when 80 degrees F and above; and each time a set of compression test specimens is made.
- 2. The testing laboratory will submit certified copies of test results directly to the OWNER and the ENGINEER after tests are made.
- B. Evaluation of Quality Control Tests:
- 1. Do not use concrete delivered to the final point of placement which has slump or total air content outside the specified values.
 - 2. Compressive strength tests for laboratory-cured cylinders will be considered satisfactory if the averages of all sets of three consecutive compressive strength tests results equal or exceed the 28 day design compressive strength of the type or class of concrete; and, no individual strength test falls below the required compressive strength by more than 500 psi.
 - a. Where questionable field conditions may exist during placing concrete or immediately thereafter, strength tests of specimens cured under field conditions will be required by the ENGINEER to check the adequacy of curing and protecting of the concrete placed. Specimens shall be molded at the same time and from the samples as the laboratory cured specimens.
 - (1) Provide improved means and procedures for protecting concrete when the 28 day compressive strength of field-cured cylinders is less than 85

percent of companion laboratory-cured cylinders.

- (2) When laboratory-cured cylinder strengths are appreciably higher than the minimum required compressive strength, field-cured cylinder strengths need not exceed the minimum required compressive strength by more than 500 psi even though the 85 percent criterion is not met.
- (3) If individual tests of laboratory-cured specimens produce strengths more than 500 psi below the required minimum compressive strength, or if tests of field-cured cylinders indicate deficiencies in protection and curing, provide additional measures to assure that the load-bearing capacity of the structure is not jeopardized. If the likelihood of low strength concrete is confirmed and computations indicate the load-bearing capacity may have been significantly reduced, tests of cores drilled from the area in question will be required at the CONTRACTOR'S expense. If the compressive strength tests fail to meet the minimum requirements specified, the concrete represented by such tests will be considered deficient in strength and subject to replacement, reconstruction or to other action approved by ENGINEER.

C. Testing Concrete Structure for Strength:

1. When there is evidence that the strength of the in-place concrete does not meet specification requirements, CONTRACTOR shall employ at his expense the services of a concrete testing compressive strength determination. Tests shall comply with ASTM C42 and the following:
 - a. Take at least 3 representative cores from each member or suspect area at locations directed by ENGINEER.
 - b. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85 percent and no single core is less than 75 percent of the 28 day required compressive strength.
 - c. Report test results in writing to ENGINEER on the same day that tests are made. Include in test reports the Project

identification name and number, date, name of CONTRACTOR, name of concrete testing service, location of test core in the structure, type or class of concrete represented by core sample, nominal maximum size aggregate, design compressive strength, compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plane of the concrete as placed, and the moisture condition of the core at time of testing.

2. Fill core holes solid with patching mortar, and finish to match adjacent concrete surfaces.
3. Conduct static load test and evaluations complying with ACI 318 if the results of the core tests are unsatisfactory, or if core tests are impractical to obtain, as directed by ENGINEER.

3.07 CONCRETE REPAIRS

- A. Repair exposed-to-view formed concrete surfaces, that contain defects which adversely affect the appearance of the finish. Surface defects that require repair include color and texture irregularities, cracks, spills, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolts; fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.
- B. Repair concealed formed concrete surfaces that may contain defects that adversely affect the durability of the concrete. Surface defects that require repair include cracks in excess of 0.01 inch wide, cracks of any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts, and spills except minor breakage at corner.
- C. Repair and patch defective areas with cement mortar immediately after removal of forms and as directed by ENGINEER.
- D. Cut out honeycomb, rock pockets, voids over ½-inch diameter, and holes left by tie rods and bolts, down to solid concrete but, in no case, to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water, and brush-coat the area to be patched with the specified bonding agent. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, the patching mortar color will match the color of the surrounding concrete. CONTRACTOR shall impart texture to repaired surfaces to match texture

of existing adjacent surfaces. Provide test areas at inconspicuous locations to verify mixture, texture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.

- E. Fill holes extending through concrete by means of a plunger-type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure complete filling.
- F. Sandblast exposed-to-view surfaces that require removal of stains, grout accumulations, sealing compounds, and other substances marring the surfaces. Use sand finer than No. 30 and air pressure from 15 to 25 psi.

END OF SECTION

SECTION 02578 PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SUBMITTALS

- A. Manufacturer's Certificates of Compliance: Submit for approval copies of manufacturer's certificates attesting that materials and equipment meet the requirements specified.
- B. Certified Test Reports: Submit for approval four certified copies of the reports of tests as required in referenced publications and Quality Control Section.

1.02 DELIVERY AND STORAGE

- A. Deliver paints and paint materials in original sealed containers that plainly show the designated name, specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer. Provide storage facilities at the job site for maintaining materials at temperatures recommended by the manufacturer.

1.03 WEATHER LIMITATIONS

- A. Apply paint to clean, dry surfaces, and unless otherwise approved, only when air and pavement temperatures are above 40 degrees F and less than 95 degrees F. Maintain paint temperature within these same limits.

1.04 TRAFFIC CONTROLS

- A. Place suitable warning signs near the beginning of the work site and well ahead of the work site for alerting approaching traffic from both directions. Place small markers along newly painted lines to control traffic and prevent damage to newly painted surfaces. Mark painting equipment with large warning signs indicating slow-moving painting equipment in operation.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide materials conforming to the requirements specified herein.
- B. Paints for Roads, Streets and Parking Areas - Fed. Spec. TT-P-115, color as selected by Architect.

2.02 EQUIPMENT

- A. Machines, tools, and equipment used in the performance of the work shall be approved by the Architect and

- maintained in satisfactory operating condition.
- B. Paint Applicator: Provide self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. Provide machine having a speed during application not less than 5 m.p.h., and capable of applying the stripe widths indicated, at the paint coverage rate specified herein and of even uniform thickness with clear-cut edges. Provide paint applicator with paint reservoirs or tanks of sufficient capacity and suitable gages to apply paint in accordance with requirements specified. Equip tanks with suitable air-driven mechanical agitators. Equip spray mechanism with quick-action valves conveniently located, and include necessary pressure regulators and gages in full view and reach of the operator. Install paint strainers in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Provide pneumatic spray guns for application of paint in areas where the mobile paint applicator cannot be used.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

- A. Allow new pavement and floor surfaces to cure for a period of not less than 30 days before application of marking materials. Thoroughly clean surfaces to be marked before application of the paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods as required. Completely remove rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the surface to be painted with scrapers, wire brushes, sandblasting, approved chemicals or mechanical abrasion. Scrub affected areas where oil or grease is present on old pavements to be marked, with several applications of trisodium phosphate solution or other approved detergent or degreaser and rinse thoroughly after each application. After cleaning oil-soaked areas, seal with shellac to prevent bleeding through the new paint. Do not commence painting in any area until pavement surfaces are dry and clean and have been inspected and approved.

3.02 APPLICATION

- A. Rate of Application: Apply paint evenly to the pavement surface to be coated at a rate of 105 (plus or minus 5) square feet per gallon.
- B. Painting: Apply paint pneumatically with approved equipment as necessary to control paint application. Take special precautions in marking numbers, letters and symbols. sharply outline all edges of markings. the maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. Discontinue painting operations if there is a deficiency in drying of the markings until cause of the slow drying is determined and corrected.

3.03 FIELD TESTING AND INSPECTION

- A. Sampling and Testing: As soon as the paint and reflective materials are available for sampling, obtain by random selection from the sealed containers, one quart sample of each batch in the presence of the Architect. Furnish duplicate samples to the Architect. Accomplish adequate mixing prior to sampling to ensure a uniform representative sample. A batch is defined as that quantity of material processed by the manufacturer at one time and identified by number on the label. Clearly identify samples by designated name, specification number, batch number, project contract number, intended use, and quantity involved. At the discretion of the Architect, samples provided may be tested by the Owner for verification.
- B. Inspection: Examine material at the job site to determine that it is the material referenced in the report of test results or certificate of compliance. Surface preparations and application procedures will be examined by the Architect to determine conformance with the requirements specified. Approve each separate operation prior to initiation of subsequent operations.

END OF SECTION

SECTION 02.600 REMOVABLE PIPE BOLLARDS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. The lockable, removable, pipe bollards, in the new service access drive.

1.02 SUBMITTALS

- A. Submit manufacturer's product data for Architect's review and approval and four (4) copies of shop drawings.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Pack in a manner to protect bollards and their finish.

1.04 PROTECTION

- A. Protect adjacent or adjoining asphalt surfaces and work from damages during installation of the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. FairWeather Site Furnishings, Port Orchard, Washington. Phone (800) 323-2626., or approved equal.

2.02 MATERIAL

- A. The B-3, 6" removable bollard shall be, 48" A.F.F., fabricated with 5" schedule 80 steel pipe, welded to a cast steel sphere with two 1 1/2" collars and to a cast steel base with one 4" collar and two 1/2" collars. Each removable bollard shall receive an eye bolt, receiver cover, lock well cover and padlock. Steel pipe shall conform to ASTM A53.
- B. The in ground receiver, for removable bollard shall be fabricated with 6.25" OD steel sleeve welded to a 3" x 5" lock well. Following fabrication, the receivers shall be hot dip galvanized to standard ASTM A123, 3 to 4 mils thick.

2.03 PROTECTIVE COATING5

- A. Powder Coating: Following fabrication bollards shall be cleaned and treated with an iron phosphate process

prior to the coating application. Bollards shall receive a corrosion resistant undercoat. The protective coatings shall be polyester TGIC powder. Following application, the parts shall be baked until properly cured. The coating shall be a minimum of 4 mils thick on all surfaces. Bollards shall be powder coated a standard FairWeather color.

PART 3 EXECUTION

3.01 PREPARATION

- A. Contractor shall properly prepare the asphalt surface, cutting carefully for the bollard foundations.
- B. Excavate the foundations to proper depths, to include 6" rock pocket for drainage.

3.02 INSTALLATION

- A. Fill the bottom of the excavations with gravel (minimum 3/4" aggregate).
- B. Install receivers centered and plumb in the foundation opening. Secure the receivers in place, during placement of concrete, at the top and using #3 rebars into 1/2" holes in receivers.
- C. Set receivers in solid 3,000 psi concrete. Slope top of concrete away from the bollards, down to the asphalt, a minimum of 1".
- D. Installation shall be in strict accordance with manufacturer's instructions.

END OF SECTION

SECTION 02720 STORM DRAINAGE SYSTEM

PART 1 GENERAL

1.01 SUBMITTALS

- A. Certified Test Reports: Before delivery of materials and equipment, certified copies of the reports of all tests specified herein shall be submitted and approved.
 - 1. Concrete Pipe: Certified copies of test reports shall include strength tests of concrete pipe. Strength tests for concrete piping shall be the three-edge bearing tests. Test reports shall be furnished prior to installation of piping.
 - 2. Pipe joint material product data
 - 3. Filter cloth product data
 - 4. Frame and grate product data
 - 5. Dewatering plan

1.02 STORAGE AND HANDLING

- A. Elliptical concrete pipe with circular reinforcing and circular pipe with elliptical reinforcing shall be transported in a vertical position, and shall be stored in such a manner as to ensure against excessive strains or loading. Proper facilities shall be provided for handling and lowering both concrete and metal sections of pipe into place to avoid injury or damage. Damaged pipe or pipe with damaged coatings shall be removed from the site and replaced with satisfactory pipe at no additional cost to the Government.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Reinforced Concrete Pipe: Shall conform to ASTM C 76 or ASTM C 506 and shall be of sizes shown. Pipe shall be Class III, unless otherwise indicated.
- B. Joints for Concrete Pipe: Shall be one of the following types:
 - 1. Bell and spigot with rubber gaskets; or,
 - 2. Tongue and groove with rubber gaskets; or,
 - a. Rubber Gaskets: Shall conform to ASTM C 443. Only a neutral agent shall be used as a

- lubricant.
 - b. Preformed Plastic Gaskets: Shall conform to Fed. Spec. SS-S-210, Type I-rope form.
 - c. Filter Cloth: Mirafi 140S, Celanese Fibers Marketing Co., Typar 3401, Dupont, Propex 4545, Amoco Fabrics Company, or acceptable equivalent.
- C. Ductile Iron Piping
 - 1. Pipe and Fittings: Pipe, except flanged pipe, AWWA C151/A21.51, Pressure Class 150. Fittings, AWWA C110/A21.10 or AWWA C153/A21.53; fittings with push-on joint ends conforming to the same requirements as fittings with mechanical-joint ends, except that the bell design shall be modified, as approved, for push-on joint. Fittings shall have pressure rating at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the specified joints.
 - 2. Joints and Jointing Material
 - a. Joints: Joints for pipe and fittings shall be push-on joints.
 - b. Push-On Joints: Shape of pipe ends and fitting ends, gaskets and lubricant for joint assembly, AWWA 111/A21.11.
- D. Polyvinyl Chloride (PVC) Plastic Piping (8- and 12-inch): Pipe shall conform to ASTM C900, 200 psi minimum pressure rating. Fittings shall conform to ASTM D 2466. Pipe and fittings shall be of the same PVC plastic material.
- E. Frames, Covers, Gratings: Conform to RR-F- 621B; cast iron, figure numbers shall be as indicated.
- F. Concrete: Section 03300.
- G. Bedding: Sand shall be well graded, organic free, durable, granular material, and shall pass No. 4 sieve. Not more than 10 percent shall pass No. 200 sieve.
- H. Rip Rap: Shall be large stone or broken pieces of unreinforced concrete weighing a minimum of 100 pounds each, meeting MDOT, Section 15.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Earthwork: Section 02222, "Excavating, Trenching & Backfilling for Underground Piping & Utilities".
- B. Each section of pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Pipe shall be laid true to the grades indicated and shall rest upon the pipe bed for the full length of each section. Runs of pipe shall be laid with outside laps or grooved ends up-grade beginning at the lower end of the pipe line. Pipe having its grade and/or joint disturbed after laying shall be taken up, cleaned, and re-laid. When pipes are protected by head walls or connect with drainage structures, the exposed ends of the pipe shall be placed or cut flush with the face of the structure. After the pipe is cut, the rough edges shall be smoothed up in an approved manner. All pipe shall be laid so that markings are on top and the inner surfaces abut neatly, tightly, and smoothly. All pipe in place shall be inspected and approved before being covered and concealed.
- C. Concrete Pipe: Joint installation shall be in accordance with the recommendations of the manufacturer of the joint material. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installation of the pipe, and any loose or improperly affixed gaskets and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pulled together. If, while making

the joint, the gasket or jointing material becomes loose and can be seen through the exterior joint recess when the joint is pulled up to within one inch of closure, the pipe shall be removed and the joint remade. Wrap pipe joints with filter cloth as indicated on the drawings.

3.02 CONCRETE CATCH BASINS AND CURB INLETS

- A. Drainage structure shall have the bottom slabs and walls poured integrally. Where this is not practicable, the bottom slabs and walls shall be keyed and bonded together properly. Concrete precast and cast-in-place bases shall have smooth inverts accurately shaped to a semi-circular bottom conforming to the inside contour of the adjacent sewer sections.

3.03 EROSION PROTECTION

- A. Preparation of Embankment: Embankment will be reshaped to conform to the new grades shown on the drawings using existing material from the site. Unstable soils will be replaced prior to placing filter cloth.
- B. Installation of Filter Fabric:
 - 1. The filter fabric shall be placed tension-free on the prepared grade. Rolls of as great a length as it is practical for the Contractor to handle shall be used in order to minimize the number of vertical joints. Vertical joints shall be lapped a minimum of 5 feet. Horizontal joints shall be sewn at the factory. Any damage to the fabric prior to or during placement of stone rip-rap shall be repaired at the Contractor's expense to the satisfaction of the Architect.
- C. Installation of Stone Rip-Rap
 - 1. Immediately after the filter fabric has been installed, place the rip-rap directly on the fabric to thickness shown on the Drawings.
 - 2. Drop height of the rip-rap shall be zero. Fabric damaged or displaced due to placement of the rip-rap shall be repaired at the Contractor's expense to the satisfaction of the Architect.
 - 3. After the rip-rap mass in the bottom is in place, the filter fabric shall be turned back as shown on the Drawings and the remainder of the rip-rap placed on top to anchor it in place.

4. The finished surface shall form a uniform appearance with the rip-rap interlocked as nearly as practicable to provide a complete cover over the filter fabric without large voids.

3.04 FIELD TESTS AND INSPECTION

- A. A light held in a manhole shall show a practically full circle of light through the pipe when viewed from the adjoining end of the line. Lines under pavement shall be tested for infiltration by means of a suitable weir or other device as directed. When determination of infiltration is not practicable because of dry trench conditions, an exfiltration test shall be applied by filling with water so that the hydraulic head will be at least 4 feet above the crown of the upper end of the section being tested. The amount of leakage (infiltration or exfiltration) shall not exceed 500 gallons per inch of diameter per day per mile of pipe. Water for testing shall be furnished by the Contractor.

END OF SECTION

SECTION 02.782 BRICK PAVERS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. BRICK PAVERS

1.02 SUBMITTALS
A. PRODUCT DATA: Provide product data about design loads, deflection, lumber, colors, finishes, setting bed requirements for each product specified.
B. SAMPLES
 1. Provide 2 samples of brick paver.
 2. Provide sand sample for approval of color.

1.03 QUALITY CONTROL
A. Meet requirements of ASTM C-902, Class SX, Type 1, Application PX.
B. 8% maximum average absorption for walkways.

PART 2 PRODUCTS

2.01 SYSTEM COMPONENTS
A. BRICK PAVERS: Provide pavers for project requirements plus 5% stockpile delivered to the Owner.
B. SAND: Natural river or bank sand, washed, free of silt, clay, loam, friable or soluble materials, and organic matter.
C. SEALANT: H&C Water Based Paver Sealer or approved equal.

2.02 MANUFACTURERS
A. Whitacre-Greer Vacuum Dry - Press Pavers (Basis of Design)
B. Pine Hall Brick Company
C. Universal Brick & Stone

2.03 DESIGN DATA
A. Minimum compressive strength: 8000 psi.
B. Dimensions: 8" x 4" x 2-3/8" thick.
C. Color: Selected by Owner
D. Pattern: See plans

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, and product catalog installation instructions.

3.02 EXAMINATION

A. Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

1. Substrate Verification: Verify compaction percentage of maximum dry density requirements.
2. Elevation Verification: Verify elevations and grades with ENGINEER.

3.03 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during product installation.

3.04 INSTALLATION

A. Setting Bed/Leveling Course

1. Sand Setting Bed: Install 1/2" sand over concrete base to attain specified finish grade. Dry cement shall be mixed into the sand bed at locations as specified on the plans.
2. Sand Joints: Lay brick pavers in patterns shown on plans with butt joints, sweep sand into joints. Repeat application of sand until there is no setting.

B. Quality Control

1. Damaged Units: Use of chipped or otherwise damaged paver units is not permitted.
2. Paver Cuttings: Cut paver units shall have sharp clean edges.

C. Pattern: As shown on plans.

D. Joints: Provide butt joints between each brick paver. Sweep sand into butt joints until there is no horizontal movement of pavers and until joints are full and there is no settlement.

E. Elevation Tolerances: Surface elevations of installed paver units shall not deviate more than 3/8 inch using a 10 foot long straightedge. All finished surfaces shall drain. Any ponding of any amount

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shall be removed and re-graded as necessary until positive drainage is achieved.

3.05 APPLYING SEALANT

A. Pavers shall be sealed with two coats of paver sealer in accordance with the paver sealer manufacturer's suggested application instructions.

3.06 CLEANING AND PROTECTION

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instruction prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.
- B. Protection: Protect installed product's finish surfaces from damage during construction.

END OF SECTION

SECTION 02.788 PEDESTAL PAVERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Concrete pedestal pavers set over modified bitumen membrane roofing system.

B. Related Sections

1. Section 07.535 - Modified Bitumen Membrane Roofing System

1.02 SUBMITTALS

A. Product Data: For the following:

1. Pavers.
2. Pedestal units.
3. Slope compensation devices.
4. Edge restraints.

B. Shop Drawings: Paver size, pattern, grid layout, starting point and finished elevation penetrations, inside and outside corners, tie-ins to adjoining surfaces, edge restraints and other termination conditions.

C. Samples for Verification:

1. Full-size units of each type of unit paver indicated. Assemble not less than five Samples of each type of unit on suitable backing and grout joints.
2. Pedestal units and shim materials.
3. Joint and spacer materials.
4. Exposed edge restraint material.

1.03 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of unit paver, joint material, and pedestal unit from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

1.05 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

1.06 WARRANTY

A. Special Manufacturer's Warranty: Written warranty, signed by pedestal manufacturer agreeing to repair or replace defective materials that do not comply with requirements or that do not remain free of defects within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Written warranty, signed by paver manufacturer agreeing to repair or replace defective materials that do not comply with requirements or that do not remain free of defects within specified warranty period.

1. Warranty that pavers will not dish or warp and will not crack, split, or disintegrate in freeze-thaw conditions.

2. Warranty Period: Ten years from date of Substantial Completion.

C. Special Installer's Warranty: Written waterproofing Installer's warranty, signed by Installer, covering Work of this Section.

1. Warranty includes removing and reinstalling pedestals and pavers on plaza decks.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PEDESTAL PAVERS

- A. Plaza Deck Pavers: Heavyweight, hydraulically pressed, concrete units, square edged, manufactured for use as plaza deck pavers; minimum compressive strength 8500 psi (60 MPa), ASTM C140; absorption not greater than 5 percent, ASTM C140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C67; and as follows:
1. Colors and Textures: As selected by Architect from manufacturer's full range.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Basis of Design: Hanover Architectural Products, Inc. Approved comparable products by Wausau Tile; Tile Tech Pavers. High Wind Guardian Paver System: Prest Paver. 23-1/2" x 23-1/2" x 2"; Hanover Elevated Pedestal System; Compensater Shims.
 3. Thickness: 2"
 4. Face Size and Shape: 23.5"
 5. Color: to be selected from manufacturer' full range.

2.02 ACCESSORIES

- A. Paver Supports: Paver manufacturer's spacing of 3/16-inch (4.5 mm).
1. Manufacturer: Hanover, Guardian Paver System: 3-piece pedestal and a shaped paver that will "lock down" to prevent horizontal and vertical movement.
- B. Pedestals Hanover's Elevator Pedestal System including pads and couplers. Joint spacing to be 1/8".
- C. Shims: Pedestal manufacturer's standard 1/16-inch thick EPDM flexible shims.
1. Manufacturer and Model: Hanover High-Tab Pedestal Leveling Shims.
- D. Expansion Joint Filler: Preformed cork strips complying with ASTM D1752, Type II.
- E. Perimeter Isolation: ASTM C1330, Type C; resilient, medium-density (3.0 pcf/48 kg/cu m), closed-cell foam.

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1. Manufacturer: Dow Chemical, Ethafoam 222, or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.
 2. Where pavers are to be installed over waterproofing, examine waterproofing installation, with waterproofing Installer present, for protection from paving operations. Examine areas where waterproofing system is turned up or flashed against vertical surfaces and horizontal waterproofing. Proceed with installation only after protection is in place.

3.02 PREPARATION

- A. Inspect surfaces scheduled to receive pedestal pavers to ensure it is clean and free of debris which would impair the performance of the pedestal system.
- B. Verify drainage mat, insulation or protection board has been installed according to manufacturer's recommendations.
- C. Verify water tests have been completed for waterproofing membrane before installation of pavers.

3.03 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.
- B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
 1. For concrete pavers, a block splitter may be used.

- D. Pavers over Waterproofing: Exercise care in placing pavers and setting materials over waterproofing so protection materials are not displaced and waterproofing is not punctured or otherwise damaged. Carefully replace protection materials that become displaced and arrange for repair of damaged waterproofing before covering with paving.
 - 1. Provide joint filler at waterproofing that is turned up on vertical surfaces, unless otherwise indicated; where unfilled joints are indicated, provide temporary filler or protection until paver installation is complete].
- E. Tolerances: Do not exceed 1/32-inch (0.8-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.
- F. Expansion and Control Joints: Provide for sealant-filled joints at locations and of widths indicated. Provide foam filler as backing for sealant-filled joints, unless otherwise indicated; where unfilled joints are indicated, provide temporary filler until paver installation is complete. Install joint filler before setting pavers. Sealant materials and installation are specified in Section 07920.

3.04 PLAZA DECK PAVER INSTALLATION

- A. Install concrete pavers and paver supports in locations indicated according to manufacturer's written instructions.
- B. Accurately install adjustable-height pedestals and other accessories to elevations required. Adjust for final level and slope with shims.
- C. Loosely lay pavers on pedestals, maintaining a uniform open joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.
 - 1. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.
- D. Do not place pedestals directly over an expansion joint. Doing so will interfere with the pedestal and paver system performance. Move the pedestals to one side or the other of the joint.
- E. Install pavers to not vary more than 1/16 inch (1.6 mm) in elevation between adjacent pavers or more than

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- 1/16 inch (1.6 mm) from surface plane elevation of individual paver.
- F. Maintain tolerances of paving installation within 1/4 inch in 10 feet (1:48) of surface plane in any direction.
 - G. Joint Pattern: As indicated.
 - H. Establish a starting point; determine the finished elevation of the paver surface and the support system elevation (finished elevation less the paver thickness). Mark these measurements around the perimeter using transit, water level or laser leveling device.
 - I. Take measurements and snap 2 perpendicular chalklines on the surface to receive the pedestals. Use these lines as a reference to check the paver layout during installation and to assure a square layout.
 - J. Begin installation of pavers, one row at a time. Place a pedestal at the starting row of pavers where each grid line meets the perimeter. Remove two spacer tabs in line with one another from atop each pedestal located along the perimeter. Adjust each to the elevation marked on the perimeter.
 - K. Position the pedestal as close to the edge of the perimeter as possible, with the two remaining spacer tabs aligned with the grid line. Using the elevation marked on the perimeter, stretch a mason's line along and slightly ahead of the second row of pedestals. A laser leveling device may also be used for this purpose.
 - L. On larger plaza decks, pre-set pedestal height to the proper elevation and place in position prior to the paver installation. As pedestals along the grid lines are loaded, and prior to installing the next row of pavers, make any required fine vertical adjustment by rotating the base or bottom of the pedestal.
 - M. Take care not to extend the height of the pedestal beyond the "quality control" slots at the base of the screw cylinder; if they become visible, they indicate that the pedestal is extended beyond the minimum engagement of threads. Replace the pedestal with the next larger size or a coupling unit as recommended by manufacturer.
 - N. Compensate for slight irregularities in paver thickness by using one or more segments of the shim

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which is placed under a paver corner(s) atop the pedestal bearing head.

1. Use shims in multiples, whole or segmented, and placed under the pedestal base to level the pedestals.
- O. Where substrate is sloped, use slope compensating units to adjust installation to plumb and level condition.
- P. At built-up roof substrates place acoustical shims between pedestals and roofing.
- Q. Place pavers as directed by paver manufacturer's written instructions. Use a paver lifter as recommended by paver manufacturer.
- R. Rotate the base of the pedestal support for slight adjustment when two pavers are already on the bearing head. Level pavers in each succeeding row.
- S. Enclose any section of paver, pedestal or protection course which is not restrained by an abutting wall or parapet so that no movement is allowed at the perimeter of a paver system greater than 1/8-inch.

3.05 FIELD QUALITY CONTROL

- A. Inspect often during installation to assure that grid (spacer) lines are straight and consistent, and that pavers are level.
- B. Where necessary, install rubber shims to eliminate "rocking" of pavers.
- C. Confirm that pedestal heights in excess of 19-inches have been braced.
- D. Unless otherwise specified to allow for expansion, do not exceed paver spacing at perimeter walls more than 1/8-inch.
- E. Examine and confirm installation to assure that all pedestrian access points to the plaza deck are level and do not have offsets in the paver surface that could create a trip hazard.

END OF SECTION

SECTION 02.830 VINYL COATED CHAINLINK FENCES AND GATES

PART 1 GENERAL

1.01 RELATED DOCUMENTS: Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work specified in this section.

1.02 DESCRIPTION OF WORK: Provide black, vinyl coated fencing and gates as indicated on Drawings and herein specified.

1.03 QUALITY ASSURANCE

A. Standards: Materials and methods of construction shall meet requirements and recommendations of applicable portions of the following industry standards:

1. ASTM A392 Zinc-Coated Steel Chain Link Fence Fabric.
2. ASTM F552 Standard Definitions of Terms Relating to Chain Link Fencing.
3. ASTM F567 Installation of Chain Link Fence.
4. ASTM F626 Fence Fittings.
5. ASTM F669 Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fences.
6. ASTM F900 Industrial and Commercial Swing Gates.

B. Provide chain link fences and gates as complete units produced by a single manufacturer including necessary erection accessories, fittings and fastenings.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for metal fencing and gates.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All fence components shall be black vinyl coated.
- B. General: Posts, gate frames, braces, post brackets, tension wire, stretcher bars, and truss rods shall be of steel. Gate hinges, stretcher bar bands, and other parts shall be of steel, malleable iron, ductile iron

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or equal except that ties and clips may be of aluminum.

- C. Posts: All posts shall be produced to conform with ASTM A-120, except the hydrostatic testing requirement is waived, standard weight (schedule 40) steel.
 - 1. End and intermediate posts shall be 2.375 inch minimum outside diameter, weighing no less than 3.65 lbs. per foot.
 - 2. Gate posts shall be 4.00 inch minimum outside diameter, weighing no less than 9.10 lbs. per foot.
 - 3. Posts shall be equal to Color Heavy-Weight PVC coated by Hegarty and Sons (610) 252-8100.
- D. Fabric: Hot dip galvanized steel chain link fence fabric, 2 inch mesh, 8 gauge wire. Conform to ASTM A392. Fabric shall have 22 mil PVC finish bonded to core wire.
- E. Gate: Pair of swing gates, complete with latches (to accept padlock), stops, keepers and hinges. Conform to ASTM F900.
 - 1. Gate frames shall be constructed of tubular members welded at all corners or assembled with fittings. Welds shall be painted with zinc based paint. Where corner fittings are used, gates shall have truss rods of 5/16 inch minimum nominal diameter to prevent sag or twist. (Gate leaves shall have vertical intermediate bracing as required, spaced so that no such members are more than 8 feet apart). Gate frames shall be constructed of 1.90 minimum outside diameter pipe, weighing no less than 2.72 lbs. per foot.
 - 2. Gate fabric shall be same as used in fence construction. Securely attach to gate frame at intervals not exceeding 15 inches.
 - 3. Gate hinges shall be of adequate strength for gate, and with large bearing surfaces for clamping in position. Hinges shall not twist or turn under the action of the gate. The gates shall be capable of being opened and closed easily by one person.
 - 4. Gate latches, stops and keepers shall be provided for all gates. Latches shall have a plunger-bar arranged to engage the center stop. Latches shall

be arranged for locking. Center stops shall consist of a device arranged to be set in concrete and to engage a plunger bar of the latch. Keepers shall consist of a mechanical device for securing the free end of the gate when in the full open position.

5. Gates, hardware and fittings shall be PVC coated similar to posts and fabric above.
- E. Fittings: Conform to ASTM F626. All fittings shall be PVC coated.
1. Tension bars shall be not less than 3/16 x 3/4 inch and not less than 2 inches shorter than the nominal height of the fabric with which they are to be used. One tension bar shall be provided for each end post.
 2. Ties or clips of adequate strength shall be provided in sufficient number for attaching the fabric to line post at intervals not exceeding 15 inches; and not exceeding 24 inches for attaching fabric to top and bottom rail.
 3. Bands or clips of adequate strength shall be provided in sufficient number for attaching the fabric and stretcher bars to all terminal posts at intervals not exceeding 15 inches. Tension bands shall be formed from flat or beveled steel and shall have a minimum thickness after galvanizing of 0.078 inch, and minimum width of 3/4 inch. Brace bands shall be formed from flat or beveled steel and shall have a minimum thickness of 0.108 after galvanizing, and minimum width of 3/4 inch. Bands shall be subject to standard mill tolerances. Attachment bolts shall be 5/16 x 1-1/4 inch galvanized carriage bolts with galvanized nuts.
 4. Tension Wire shall be Marcellled (spiraled or crimped) #7 gage (.177 inches) plus or minus 0.005 inches in diameter, conforming to ASTM A-824. Zinc coated tension wire shall be Class 2 (1.20 oz. of zinc per sq. ft. of uncoated wire surface). Aluminum coated tension wire shall have 0.40 oz. of aluminum per sq. ft. of uncoated wire surface. Use tension wire at top of fence without top rail.
- F. Provide and install block privacy slats.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Unless otherwise indicated, install fence in accordance with ASTM F567. Layout complete fence line and mark post locations before concrete slab and grade beam is poured.
- B. Post Anchorage: Provide galvanized pipe sleeves (8" long for line and intermediate posts; 16" long for gate posts), with inside diameter approximately 1 inch greater than post outside diameter, set in building concrete slab and grade beam. Sleeve bottoms shall be closed.
- C. In lieu of pipe sleeves posts may be set in core drilled holes of same depth.
- D. Setting Posts: Center and plumb posts in pipe sleeves or cored holes and fill around posts solidly with non-shrink, non-metallic grout recommended for exterior locations (Minwax Super Por-Rok, or equal), mixed and placed to comply with grout manufacturer's directions.
- E. Attach posts to masonry piers near top, with pipe brackets.
- F. Pull fabric taut and tie to posts and tension wire. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.
- G. Stretcher Bars: Thread through or clamp to fabric 4 inches on center and secure to posts with metal bands spaced 15 inches on center.
- H. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage, as recommended by fence manufacturer. Adjust hardware for smooth operation and lubricate where necessary.
- I. Tie Wires: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two full turns. Bend wire ends to minimize hazard to persons or clothing.

J. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

END OF SECTION

SECTION 03.200 CONCRETE REINFORCING

PART 1 GENERAL

1.01 RELATED SECTIONS

- A. Division 1 Sections
- B. Section 03.100 - Concrete Forming and Accessories.
- C. Section 03.300 - Cast-in-Place Concrete.
- D. Section 03.412 - Precast Prestressed Concrete.

1.02 REFERENCES

ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.

ACI 301 - Standard Specifications for Structural Concrete.

ACI 315 - Details and Detailing of Concrete Reinforcement.

ACI 318 - Building Code Requirements for Structural Concrete.

ASTM A1064 - Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

AWS D1.4 - Structural Weld Code - Reinforcing Steel.

AWS D12.1 - Recommended Practices for Welding Reinforcing Steel Metal Inserts, and Connections in Reinforced Concrete Construction.

CRSI - Manual of Standard Practice.

1.03 SUBMITTALS

- A. Refer to Structural Quality Assurance Plan in the Structural Drawings for additional submittal requirements.

- B. Shop Drawings
 - 1. Notify Structural Engineer prior to detailing reinforcing steel shop drawings.
 - 2. Indicate size, spacing, location and quantities of reinforcing steel and wire fabric, bending and cutting schedules, splice lengths, stirrup spacing, supporting and spacing devices. Detail reinforcing steel in accordance with ACI 315 and CRSI Standards.
 - 3. Written description of reinforcement without adequate sections, elevations, and details is not acceptable.
 - 4. Reproduction of Structural Drawings for shop drawings is not permitted. Electronic drawing files will not be provided to the Contractor.
- C. Submit manufacturer's data for tension and compression splicers.

1.04 QUALITY ASSURANCE

- A. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

1.05 STORAGE AND PROTECTING

- A. Store reinforcing steel above ground so that it remains clean. Maintain steel surfaces free from materials and coatings that might impair bond.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Deformed Reinforcing Steel: ASTM A615, refer to Structural Drawings for grade (Grade 60 minimum).
- B. Welded Steel Wire Fabric: ASTM A185.

2.02 ACCESSORY MATERIALS

- A. Annealed Steel Tie Wire: 16½ gage minimum.
- B. Bar Supports: Plastic-tipped steel Class I bar supports conforming to CRSI Specifications. Concrete brick may be used to support reinforcement to obtain proper clearance from earth.

2.03 SPLICERS

- A. Tension Splicers: Capable of developing 125% of the reinforcing steel ASTM specified minimum yield strength.

- B. Compression Splicers: Mechanical type such that the compression stress is transmitted by end bearing held in concentric contact.

2.04 DOWEL ADHESIVE

- A. Dowel Adhesive: EPCON System Ceramic 6 Epoxy adhesive supplied by ITW Ramset/Red Head, HIT HY150 injection adhesive supplied by Hilti Fastening Systems, Power-Fast epoxy injection gel or AC100 Plus supplied by Powers Fasteners, SET High Strength Epoxy supplied by Simpson, or approved equal.

PART 3 EXECUTION

3.01 FABRICATION

- A. Fabricate reinforcing steel in accordance with ACI 318 and CRSI standards.
- B. Bend bars cold. Do not heat or flame cut bars. No field bending of bars partially embedded in concrete is permitted, unless specifically approved Structural Engineer and checked by Testing and Inspection Agency for cracks.
- C. Weld only as indicated. Perform welding in accordance with AWS D1.4 and AWS D12.1.
- D. Tag reinforcing steel for easy identification.

3.02 INSTALLATION

- A. Before placing concrete, clean reinforcement of foreign particles and coatings.
- B. Place, support, and secure reinforcement against displacement in accordance with ACI 318 and CRSI standards. Do not deviate from alignment or measurement.
- C. Place concrete beam reinforcement support parallel to main reinforcement.
- D. Locate welded wire reinforcement in the top third of slabs. Overlap mesh one lap plus two inches at side and end joints.
- E. Furnish and install dowels or mechanical splices at intersections of walls, columns and piers to permit continuous reinforcement or development lengths at such intersections.
- F. Maintain cover and tolerances in accordance with ACI and CRSI Specifications, unless indicated otherwise on Structural Drawings.

- 3.03 SPLICES
- A. Do not splice reinforcement except as indicated on Structural Drawings.
 - B. Tension couplers may be used and installed in accordance with manufacturer's recommendations.
- 3.04 DOWELS IN EXISTING CONCRETE
- A. Install dowels and dowel adhesive in accordance with manufacturer's recommendations.
 - B. Minimum embedment length into the existing concrete shall be 12 bar diameters, unless noted otherwise.

END OF SECTION

SECTION 03300 CAST-IN-PLACE CONCRETE (STRUCTURAL)

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. The work includes the provision of cast-in-place concrete. In the ACI publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears; reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" shall be interpreted to mean the Architect.

1.02 SUBMITTALS

- A. Shop Drawings: Reproductions of contract drawings are unacceptable. Submit prior to fabrication.
1. Shop Drawings for Reinforcing Steel: ACI 315. Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing rods. Submit to the Architect.
 2. Shop Drawings for Reinforcing Steel Placement: The contract drawings and electronic data files shall not be used to prepare placement drawings. Prepare sections, details, elevations and other drawings for field personnel to properly place reinforcing. Indicate spacings, clearances, cover, bolsters and any other information for correct placing of the reinforcement. Submit to the Architect with reinforcing steel shop drawings.
- B. Contractor Mix Design: Thirty (30) days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Proportioning of mix and submittal of mix design shall conform to ACI 318 Section 5.3. Cylinder break data used shall be submitted with the mix design submittal. Mix designs submitted without supporting cylinder break data will be rejected without review. If required cylinder break data is not available as required by ACI and the International Building Code, then increase design strength shown on the drawings by 1200 psi. Furnish complete list of materials including type, brand, source and amount of cement, fly ash, pozzolan, ground slag, and admixtures, and applicable reference specifications. Provide fly ash and pozzolan test results performed within 6 months of submittal date. Architect review is required before concrete placement. Submit additional data regarding concrete aggregates if the source of aggregate changes.

- C. Certificates of Compliance:
 - 1. Aggregates
 - 2. Admixtures
 - 3. Reinforcement - Mill reports and recycled material content
 - 4. Cement
 - 5. Fly ash
 - 6. Pozzolan
 - 7. Ground slag
- D. Catalog Data:
 - 1. Materials for curing concrete
 - 2. Joint sealant
 - 3. Joint filler
 - 4. Vapor barrier
 - 5. Reinforcing bolsters
 - 6. Epoxy
- E. Post-Installed Anchors
ICC ES Evaluation Reports
 - 1. Manufacturer's Installation Instructions
 - 2. Installer Qualifications

1.03 DELIVERY

- A. Do not deliver concrete until vapor barrier, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement, and required inspections by the appropriate authorities have been completed.

1.04 STORAGE

- A. ACI 301 for job site storage of concrete aggregates. Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Provide for accurate identification after bundles are broken and tags removed.

1.05 FORMWORK

- A. The Contractor shall be solely responsible for the ability of formwork to produce members of the size, shape, alignment and finish required for structure adequacy. Contractor shall provide forms that carry construction loads safely and without excessive deflection. The Contractor shall be solely responsible for any injury or damage arising from inadequate forms or from premature removal of formwork.
- B. Formwork design, engineering, construction and removal shall conform to ACI 318, Building Code Requirements for Reinforced Concrete, and ACI 347, Guide to Formwork for Concrete.
- C. Where formwork will provide support for fresh elevated concrete or where formwork will be used to support shoring or

re-shoring, provide sealed design calculations indicating arrangement of forms, size and grades of supports, panels and related components. Calculations must indicate concrete pressure with both live and dead loads, along with concrete strength requirements before removal of forms and shoring.

1.06 CONTROL SUBMITTALS

- A. Concrete Curing Plan: Submit proposed materials, methods and duration for curing concrete elements in accordance with ACI 308.1.
- B. Pumping Concrete: Submit proposed materials and methods for pumping concrete. Submittal must include mix designs, pumping equipment, including type of pump and size and material for pipe, and maximum length and height concrete is to be pumped.
- C. Finishing Plan: Submit proposed material and procedures to be used in obtaining the finish for the floors. Include qualification of person to be used for obtaining floor tolerance measurement, description of measuring equipment to be used, and a sketch showing lines and locations the measuring equipment will follow.

PART 2 PRODUCTS

2.01 CONCRETE

- A. Contractor-Furnished Mix Design: ACI 211.1 and ACI 301 and ACI 211.2. Concrete shall have a 28-day compressive strength of indicated or specified below.

<u>Location</u>	<u>Strength</u>	<u>Max W/C Ratio</u>	<u>Air Entr.</u>	<u>Slump*</u>
Columns	5000 psi	.5	4	6
Beams & Slabs	4000 psi	.5	4	6
Walls	5000 psi	.5	4	6
Footings	3000 psi	.5	4-6	4
Grade Slabs	3500 psi	.5	1-2%	4
All other work	3000 psi	.5	4-6%	4"

*Slump requirement is before the addition of High Range Water Reducer admixture (HRWR). Maximum slump after addition of HRWR is 8-inches. Slump shall be checked before and after the addition of HRWR.

2.02 MATERIALS

- A. Cement: ASTM C150, Type I or II or ASTM C595, Type IP blended cement, except as modified herein. The blended cement shall consist of a mixture of ASTM C150 cement and one of the following materials: ASTM C618 pozzolan or fly ash, or ASTM C989 ground iron blast furnace slag. The

pozzolan/fly ash content shall not exceed 25 percent by weight of the total cementitious material and the ground iron blast furnace slag shall not exceed 50 percent by weight of total cementitious material. For exposed concrete, use one manufacturer for each type of cement, ground slag, fly ash, and pozzolan.

1. Fly Ash and Pozzolan: ASTM C618, Class F, except that the maximum allowable loss on ignition shall be 6 percent for Type F. Add with cement.
 2. Ground Iron Blast-Furnace slag: ASTM C989, Grade 120.
- B. Water: Water shall be fresh, clean, and potable.
- C. Aggregates: ASTM C33, except as modified herein. Obtain aggregates for exposed concrete surfaces from one source. Aggregates shall not contain any substance which may be deleteriously reactive with the alkalies in the cement.
- D. Nonshrink Grout: ASTM C1107.
- E. Admixtures:
1. Air-Entraining: ASTM C260.
 2. Accelerating: ASTM C494, Type C.
 3. Retarding: ASTM C494, Type B, D, or G.
 4. Water Reducing: ASTM C494, Type A, E, or F.
- F. Materials for Forms: Provide wood, plywood, or steel. Use plywood or steel forms where a smooth form finish is required. Lumber shall be square edged or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Plywood: PS 1, B-B concrete form panels or better. Steel form surfaces shall not contain irregularities, dents, or sags.
- G. Reinforcement:
1. Reinforcing Bars: ASTM A615 or A706 for welded applications. ASTM A615 rebar shall not be welded.
 2. Welded Wire Fabric: ASTM A1064. Provide flat sheets only of welded wire fabric for slabs.
 3. Wire: ASTM A82.
 4. Smooth Dowels: Plain steel; ASTM A675, Grade 80 or ASTM A499.
 5. Zinc coated (galvanized) bars shall comply with ASTM A767, Class II coating, galvanized after fabrication.
 6. Epoxy-coated bars shall comply with ASTM A934.
- H. Materials for Curing Concrete:
1. Impervious Sheeting: ASTM C171; waterproof paper, clear or white polyethylene sheeting, or polyethylene-coated burlap.
 2. Pervious Sheeting: AASHTO M182.
 3. Liquid Membrane-Forming Compound: ASTM C309, Type 2, Class B.
 4. Liquid Chemical Sealer-Hardener Compound: Shall be a magnesium fluosilicate compound which when mixed with water penetrates the concrete and seals and hardens the

surface of the concrete. Do not use on exterior slabs exposed to freezing conditions. Compound shall not reduce the adhesion of resilient flooring, tile, paint, roofing, waterproofing, or other material applied to concrete.

- I. Expansion/Contraction Joint Filler: ASTM D1751 or ASTM D1752, 1/2-inch thick, unless otherwise indicated.
- J. Joint Sealants:
 - 1. Horizontal Surfaces (3 percent slope, maximum):
 - a. Outside Buildings: ASTM D6690.
 - b. Inside Buildings: ASTM D6690.
 - 2. Vertical Surfaces (greater than 3 percent slope): ASTM C920, Type M, Grade NS, Class 25, Use T.
- K. Release Agent for Fiberglass Forms: Nox-Crete.
- L. Waterstops: Manufacture waterstops from a prime virgin resin; reclaimed material is not acceptable. The compound must contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops conforming to COE CRD-C 513. Polyvinylchloride waterstops conforming to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops conforming to ASTM D471.
- M. Post-Installed Anchors:
 - 1. Fasteners and Anchors:
 - a. Bolts and Studs: ASTM A307; ASTM A449 where "high strength" is indicated on the Drawings.
 - b. Carbon and Alloy Steel Nuts: ASTM A563.
 - c. Carbon Steel Washers: ASTM F436.
 - d. Carbon Steel Threaded Rod: ASTM A36; or ASTM A193 Grade B7; or ISO 898 Class 5.8.
 - e. Wedge Anchors: ASTM A510; or ASTM A108.
 - f. Stainless Steel Bolts, Hex Cap Screws, and Studs: ASTM F593.
 - g. Stainless Steel Nuts: ASTM F594.
 - h. Zinc Plating: ASTM B633.
 - i. Hot-Dip Galvanizing: ASTM A153.
 - j. Reinforcing Dowels: ASTM A615
 - 2. CAST-IN-PLACE BOLTS
 - a. Anchors, Bolts, Nuts, and Washers: Bolts and studs, nuts, and washers shall conform to ASTM A307, Grade A, and ASTM A449, ASTM A563, and ASTM F436, as applicable. Hot-dip galvanized bolts and studs including associated nuts and washers in accordance with ASTM A153.
 - 3. DRILLED-IN ANCHORS
 - a. Wedge Anchors: Wedge type, torque-controlled, with impact section to prevent thread damage complete with required nuts and washers. Provide anchors with length identification markings conforming to ICC ES

AC01 or ICC ES AC193. Type and size as indicated on Drawings.

- 1) Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
 - 2) Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. Stainless steel nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
- b. Screw Anchors: Screw type. Pre-drilling of the hole requires a standard ANSI drill bit with the same diameter as the anchor and installing the anchor will be done with an impact wrench. Provide anchors with a diameter and anchor length marking on the head. Type and size as indicated on Drawings.
- 1) Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating equivalent to DIN EN ISO 4042 (8 μ m min.).
- c. Cartridge Injection Adhesive Anchors: Threaded steel rod, inserts or reinforcing dowels, complete with nuts, washers, polymer or hybrid mortar adhesive injection system, and manufacturer's installation instructions. Type and size as indicated on Drawings.
- 1) Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel threaded rods conforming to ASTM A36, ASTM A193 Type B7 or ISO 898 Class 5.8 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1) [or carbon steel HIT TZ rods conforming to ASTM A510 with chemical composition of AISI 1038].
 - 2) Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.

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- a. Reinforcing dowels shall be A615 Grade 60.
- b. Capsule Anchors: Threaded steel rod, inserts and reinforcing dowels with 45 degree chisel point, complete with nuts, washers, glass or foil capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, and manufacturer's installation instructions. Type and size as indicated on Drawings.
 - 1) Interior Use: Unless otherwise indicated on the Drawings, provide chisel-pointed carbon steel rods conforming to ASTM A36, ASTM A193 Type B7 or ISO 898 Class 5.8 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
 - 2) Exterior Use: As indicated on the Drawings, provide chisel-pointed stainless steel anchors. Stainless steel anchors shall be AISI Type 304 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
- c. Reinforcing dowels shall be A615 Grade 60, with 45-degree chisel-points at embedded end.
- d. Epoxy Bonding Agent: Sikadur 32 HI-MOD, Simpson FX-752, or approved equal.

PART 3 EXECUTION

3.01 FORMS

- A. ACI 301. Provide forms, shoring, and scaffolding for concrete placement unless indicated or specified otherwise. Concrete for footings may be placed in excavations without forms upon observation and approval by the Architect. Excavation width shall be a minimum of 4- inches greater than indicated. Set forms mortar-tight and true to line and grade. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch unless otherwise indicated. Provide formwork with clean-out openings to permit inspection and removal of debris. Forms submerged in water shall be watertight.
- B. Coating: Before concrete placement, coat the contact surfaces of forms with a nonstaining mineral oil, nonstaining form coating compound, or two coats of nitrocellulose lacquer. Do not use mineral oil on forms

for surfaces to which adhesive, paint, or other finish material is to be applied.

- C. Removal of Forms: Prevent concrete damage during form removal. After placing concrete, forms shall remain in place for the following minimum time periods. The minimum time period for removal of forms shall govern where it exceeds the minimum specified curing period. Where the formwork for one element supports the formwork for another element, the greater time period shall apply to both elements. Where concrete supports other work in progress, forms and shores shall not be removed until concrete reaches 85% of its design compressive strength.

<u>Element</u>	<u>Time Period</u> <u>(Days Minimum)</u>
Walls and column	3
Elevated slabs and beams	7

3.02 PLACING REINFORCEMENT & MISCELLANEOUS MATERIALS

- A. Fabricate and place reinforcing steel as specified, as shown on shop drawings, and in accordance with ACI 318. Provide bars, wire fabric, wire ties, supports, and other devices necessary to install and secure reinforcement. Reinforcement shall not contain rust, scale, oil, grease, clay, and foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross sectional area or the nominal weight per foot of the reinforcement has been reduced to less than specified in paragraph entitled "Reinforcing Bars." Remove loose rust prior to placing steel. Tack welding is prohibited, unless ASTM A706 rebar is provided.
- B. Vapor Barrier: Provide beneath the on-grade concrete floor slab. Use the greatest widths and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of 12-inches. Remove torn, punctured, or damaged vapor barrier material and provide with new vapor barrier prior to placing concrete. Concrete placement shall not damage vapor barrier material.
- C. Support: Place reinforcement and secure with galvanized or noncorrodible chairs, spacers, or metal hangers. Use 4000 psi concrete blocks or other noncorrodible material for supporting reinforcement on the ground within footings or grade beams. Use steel chairs with sand plates to support reinforcement in grade slabs. Use steel bolsters with rubber tips to support reinforcement in forms above grade.
- D. Splicing: ACI 318, except as otherwise indicated or specified. Splices shall be approved prior to use. Do not splice at points of maximum stress. Overlap welded wire

- fabric the spacing of the cross wires, plus 2- inches.
- E. Cover: ACI 318 for minimum coverage, unless otherwise indicated.
 - F. Setting Miscellaneous Material: Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.
 - G. Construction Joints: Locate joints to least impair strength. Continue reinforcement across joints unless otherwise indicated.
 - H. Contraction Joints: Contraction joints in building slabs shall be constructed by cutting the concrete with a saw after concrete has set. Make joints 1/8 inch to 3/16 inch wide and extend into the slab one-fourth the slab thickness, minimum. Contraction joints in pavement slabs shall be tooled; saw cutting is not permitted.
 - I. Sawed Joints: Saw joints early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Start cutting as soon as the concrete has sufficiently to prevent raveling of the edges of the saw cut. Complete cutting before shrinkage stresses become sufficient to produce cracking. Use concrete sawing machines that are adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Cut joints to true alignment and in sequence of concrete placement continue joints to edge of slab. Remove sludge and cutting debris.
 - J. Expansion Joints: Use preformed expansion joint filler in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. Extend the filler to the full slab depth, unless otherwise indicated. Neatly finish the edges of the joint with an edging tool of 1/8 inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, install the filler strips at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. Remove the wood strip after concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. Thoroughly clean the groove of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust. If blowing out the groove, use oil-free compressed air.
 - K. Form Ties and Accessories: The use of wire alone is prohibited. Form ties and accessories shall not reduce the

effective cover of the reinforcement. Bend or cut ends of wires to provide minimum 1" cover.

L. Waterstop: Install in strict accordance with manufacturer's recommendations and as indicated.

M. Welded-Wire Reinforcement Placement:

1. Place welded-wire reinforcement in slabs as indicated. Reinforcement placed in slabs on grade must be continuous between expansion, construction, and contraction joints. Reinforcement placement at joints must be as indicated.

2. Lap splices in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Stagger laps to avoid continuous laps in either direction. Wire or clip together reinforcement at laps at intervals not to exceed 4 feet. Position reinforcement by the use of supports.

N. Dowel Installation: Install dowels in slabs on grade at locations indicated and at right angles to joint being doweled. Accurately position and align dowels parallel to the finished concrete surface before concrete placement. Rigidly support dowels during concrete placement. Coat one end of dowels with a bond breaker.

O. Drilled-In Anchors:

1. Drill holes with rotary impact hammer drills. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.

a. Cored Holes: Where anchors are permitted to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer. Properly clean cored hole per manufacturer's instructions.

b. Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.

c. Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

2. Perform anchor installation in accordance with manufacturer instructions.

- P. Wedge Anchors, Heavy-Duty Sleeve Anchors, and Undercut Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in part to be fastened. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Engineer.
- Q. Cartridge Injection Adhesive Anchors: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.
- R. Capsule Anchors: Perform drilling and setting operations in accordance with manufacturer instructions. Clean all holes to remove loose material and drilling dust prior to installation of adhesive. Remove water from drilled holes in such a manner as to achieve a surface dry condition. Capsule anchors shall be installed with equipment conforming to manufacturer recommendations. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

3.03 MEASURING, MIXING, TRANSPORTING AND PLACING CONCRETE

- A. ASTM C 94, ACI 301, ACI 302.1R, and ACI 304, except as modified herein. Provide mandatory batch ticket information for each load of ready mix concrete. Batch tickets must include maximum amount of water that can be added in the field.
- B. Measuring: Make moisture, weight, and air determinations at intervals as specified in paragraph entitled "Sampling and Testing." Allowable tolerances for measuring cement and water shall be 1 percent; for aggregates, 2 percent; and for admixtures, 3 percent.
- C. Mixing: ASTM C94. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition

of cement to aggregates if the air temperature is less than 85 degrees F. Reduce mixing time and place concrete within 60 minutes if the air temperature is greater than 85 degrees F. Additional water may be added, provided that both the specified maximum slump and water-cement ratio are not exceeded. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch. No admixtures may be added on site unless manufacturer's requirements are strictly followed and concrete supplier provides direct jobsite supervision.

- D. Transporting: Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as required.
- E. Placing: Place concrete as soon as practicable after the forms and the reinforcement have been inspected by the appropriate authorities. Do not place concrete when weather conditions prevent proper placement and consolidation; in uncovered areas during periods of precipitation; or in standing water. Prior to placing concrete, remove dirt, construction debris, water, snow, and ice from within the forms. Deposit concrete as close as practicable to the final position in the forms. Do not exceed a free vertical drop of 3 feet from the point of discharge. Place concrete in one continuous operation from one end of the structure towards the other.
 - 1. Vibration: ACI 301. Furnish a spare vibrator on the job site whenever concrete is placed. Consolidate concrete slabs greater than 4-inches in depth with high frequency, internal, mechanical vibrating equipment supplemented by hand spading and tamping. Consolidate concrete slabs 4-inches or less in depth by wood tampers, spading, and settling with a heavy leveling straight edge. Operate vibrators with vibratory element submerged in the concrete, with a minimum frequency of not less than 6000 impulses per minute when submerged. Do not use vibrators to transport the concrete in the forms. Insert and withdraw vibrators approximately 18- inches apart. Penetrate the previously placed lift with the vibrator when more than one lift is required. Place concrete in 18-inch maximum vertical lifts. External vibrators shall be used on the exterior surface of the forms when internal vibrators do not provide adequate consolidation of the concrete.
- F. Cold Weather: ACI 306R. Provide 50 degrees F minimum concrete temperature. Obtain approval prior to placing concrete when the ambient temperature is below 40 degrees F

or when concrete is likely to be subjected to freezing temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain 50 degrees F minimum adjacent to both the formwork and the structure while curing. Limit the rate of cooling to 5 degrees F in any one hour and 50 degrees F per 24 hours after heat application.

- G. Hot Weather: ACI 305R. Provide and maintain required concrete temperature using Figure 2.1.5 in ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment (where work site is remote to water source) to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

3.04 SURFACE FINISHES (EXCEPT FLOOR & SLAB FINISHES)

- A. Defects: Repair formed surfaces by removing minor honeycombs, pits greater than one square inch surface area or 0.25-inch maximum depth, or otherwise defective areas. Provide edges perpendicular to the surface and patch with nonshrink grout. Patch tie holes and defects when the forms are removed. Concrete with extensive honeycomb (including exposed steel reinforcement, cold joints, entrapped debris, separated aggregate, or other defects) which affect the serviceability or structural strength will be rejected, unless correction of defects is approved. Obtain proposed concurrence of Architect for corrective action prior to repair. The surface of the concrete shall not vary by more than the allowable tolerances of ACI 347. Exposed surfaces shall be uniform in appearance and finished to a smooth form finish unless otherwise specified.
- B. Not Against Forms (Top of Walls): Surfaces not otherwise specified shall be finished with wood floats to even surfaces. Finish shall match adjacent finishes.
- C. Formed Surfaces:
1. As-Cast Rough Form (for Surfaces Not Exposed to Public View): Remove fins and other projections exceeding 0.25-inch in height; level abrupt irregularities.

2. As-Cast Smooth Form (for Surfaces Exposed to Public View):
Form facing material shall produce a smooth, hard, uniform texture on the concrete. Remove fins and other projections. Provide light sandblast where indicated on the drawings.
 3. Sandblast and provide light sandblast finish where indicated on the drawings.
- D. Rubbed Finish: Provide concrete with a smooth form finish. Finish as follows:
1. Smooth Rubbed: Provide on newly hardened concrete within 24 hours following form removal. Wet surfaces and rub with an abrasive tool to produce uniform color and texture. Use only the cement paste drawn from the concrete rubbing process.

3.05 FLOOR, SLAB & MISCELLANEOUS CONSTRUCTION

- A. Before construction of slabs on ground, have underground work on pipes and conduits completed, tested as required, inspected by appropriate authorities and observed by Architect. Underground pipes and conduits shall be located below the bottom of slabs.
- B. ACI 302.1R, unless otherwise specified. Slope floors uniformly to drains where drains are provided. Depress the concrete base slab where indicated on Structural or Architectural plans. Provide interior floor slabs with a steel troweled finish. After troweling is completed, apply a liquid chemical sealer-hardener compound on interior floor slabs that do not receive floor covering or floor polishing.
- C. Flatness/Levelness Requirements:
 1. Elevated Slabs: Finish to within 3/16" as measured with a 10 foot straightedge and 1/32" as measured with a 1 foot straightedge.
 2. First Floor Classrooms, Offices, etc.: $F_F = 35$ overall with a minimum value of 24,
 $F_L = 25$ overall with a minimum value of 18.Contractor is required to repair and retest any floors not meeting specified tolerances. Prior to repair, Contractor must submit and receive approval for the proposed repair, including product data from any materials proposed. Repairs must not result in damage to the structural integrity of the floor. For floors exposed to public view, repairs must prevent any uneven or unusual coloring of the surface.
- D. Finish: Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to

absorb bleedwater.

1. Floated: Provide for machinery pads and other exterior slabs where not otherwise specified. Float the surface by hand with a wood or magnesium float, or use a power-driven float.
 2. Steel Troweled: First, provide a floated finish. When slab attains a proper set, trowel to a smooth, hard, dense finish. Finished surfaces shall be free of troweled marks, uniform in texture, and a true plane, level and flat within specified tolerance; hand-finish portions of the slab not accessible to power finishing equipment (e.g., edges, corners) to match the remainder of the slab. Power trowel once and finally hand trowel where a finished floor covering (e.g., tile, carpet) is specified. Power trowel twice and finally hand trowel for exposed concrete floors.
 3. Broomed: Provide for exterior walks, platforms, patios, and ramps, unless otherwise indicated. Provide a floated finish, then finish with a flexible bristle broom. Permit surface to harden sufficiently to retain the scoring or ridges. Broom transverse to traffic or at right angles to the slope of the slab.
- E. Concrete Walks: Provide 4-inches thick minimum. Provide contraction joints spaced every 5 linear feet unless otherwise indicated. Cut contraction joints 3/4-inch deep with a jointing tool after the surface has been finished. Provide 0.5-inch thick transverse expansion joints at changes in direction where sidewalk abuts curb, steps, rigid pavement, or other similar structures; space expansion joints every 20 feet maximum apart. Provide walks with a broomed finish. Provide a transverse slope of 1/4-inch per foot, unless noted otherwise. Limit variation in cross section to 1/4-inch in 5 feet. Maintain ADA slope requirements for all walks and paved areas.
- F. Pits and Trenches: Place bottoms and walls monolithically or provide waterstops and keys.
- G. Curbs: Reinforce as indicated. Provide contraction joints spaced every 10 feet maximum unless otherwise indicated. Align joints in curbs with joints in pavement. Cut contraction joints 3/4-inch deep with a jointing tool after the surface has been finished. Provide expansion joints 1/2-inch thick and spaced as indicated. Provide a pavement finish.

3.06 CURING AND PROTECTION

- A. ACI 301 unless otherwise specified. Begin curing immediately after placement. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out

from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period.

- B. Moist Curing: Provide for the removal of water without erosion or damage to the structure.
1. Ponding or Immersion: Continually immerse the concrete throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete. For temperatures between 40 and 50 degrees F, increase the curing period by 50 percent.
 2. Fog Spraying or Sprinkling: Provide uniform and continuous application of water throughout the curing period. For temperatures between 40 and 50 degrees F, increase the curing period by 50 percent.
 3. Pervious Sheeting: Completely cover surface and edges of the concrete with two thicknesses of wet sheeting. Overlap sheeting 6-inches over adjacent sheeting. Sheeting shall be at least as long as the width of the surface to be cured. During application, do not drag the sheeting over the finished concrete nor over sheeting already placed. Wet sheeting thoroughly and keep continuously wet throughout the curing period.
 4. Impervious Sheeting: Wet the entire exposed surface of the concrete thoroughly with a fine spray of water and cover with impervious sheeting throughout the curing period. Lay sheeting directly on the concrete surface and overlap edges 12-inches minimum. Provide sheeting not less than 18-inches wider than the concrete surface to be cured. Secure edges and transverse laps to form closed joints. Repair torn or damaged sheeting or provide new sheeting. Cover or wrap columns, walls, and other vertical structural elements from the top down with impervious sheeting, overlap and continuously tape sheeting joints, and introduce sufficient water to soak the entire surface prior to completely enclosing.
- C. Liquid Membrane-Forming Compound Curing: Seal or cover joint openings prior to application of curing compound. Prevent curing compound from entering the joint. Provide and maintain compound on the concrete surface throughout the curing period. Do not use this method of curing where the use of Figure 2.1.5 in ACI 305R indicates that hot weather conditions will cause an evaporation rate exceeding 0.2 pound of water per square foot per hour.

1. Application: Unless the manufacturer recommends otherwise, apply compound immediately after the surface loses its water sheen and has a dull appearance, and before joints are sawed. Mechanically agitate curing compound thoroughly during use. Use approved power-spraying equipment to uniformly apply two coats of compound in a continuous operation. The total coverage for the two coats shall be 200 square feet maximum per gallon of undiluted compound unless otherwise recommended by the manufacturer's written instructions. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel. Immediately apply an additional coat of compound to areas where the film is defective. Respray concrete surfaces subjected to rainfall within 3 hours after the curing compound application.
 2. Protection of Treated Surfaces: Prohibit foot and vehicular traffic and other sources of abrasion for not less than 72 hours after compound application. Maintain continuity of the coating for the entire curing period and immediately repair any damage.
- D. Liquid Chemical Sealer-Hardener Curing: Apply to interior floors that do not receive a floorcovering. Apply the sealer-hardener in accordance with manufacturer's recommendations. Seal or cover joints and openings in which joint sealant is to be applied as required by the joint sealant manufacturer. The sealer-hardener shall not be applied until the concrete has cured for a minimum of 30 days. Apply a minimum of two coats of sealer-hardener.
- E. Curing Periods and Minimum Temperatures: After placing concrete, maintain air temperature adjacent to the concrete at 50 degrees F minimum for the specified time period, or 70 degrees F minimum for a period of 3 days after placing, and 40 degrees F minimum for the remainder of the specified time period.

<u>Time Period</u> (Days Minimum)	<u>Concrete Structure or Cement Type</u>
7	ASTM C150, Type I or II, either with or without fly ash, pozzolan, or ground slag; and ASTM C595 cement for concrete not specified otherwise.
10	Retaining walls that will be subjected to frost action or similar deteriorating conditions; pavement not under a roof.

1. Additional Curing: Double the required curing period if either one or the average of both 7-day test cylinders indicate less than 75 percent of the strength specified ($f'c$).

3.07 SAMPLING AND TESTING

A. Sampling: ASTM C172. Collect samples of fresh concrete to perform tests specified. ASTM C31 for making test specimens.

B. Testing:

1. Slump Tests: ASTM C143. Take concrete samples during concrete placement. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cement ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 10 cubic yards (maximum) of concrete. Perform slump test before and after addition of superplasticizer.
2. Temperature Tests: Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 10 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.
3. Compressive Strength Tests: ASTM C39. Make five test cylinders for each set of tests in accordance with ASTM C31. Test two cylinders at 7 days, two cylinders at 28 days, and hold one cylinder in reserve. Samples for strength tests of each mix design of concrete placed each day shall be taken not less than once a day, nor less than once for each 100 cubic yards of concrete, nor less than once for each 5000 square feet of surface area for slabs or walls. For the entire project, there shall be no less than five sets of samples taken and strength tests performed for each mix design of concrete placed. Each strength test result shall be the average of two cylinders from the same concrete sample tested at 28 days. If the average of any three consecutive strength test results is less than $f'c$ or if any strength test result falls below $f'c$ by more than 500 psi, take a minimum of three ASTM C42 core samples from the in-place work represented by the low test cylinder results and test. Concrete represented by core tests shall be considered structurally adequate if the average of three cores is equal to at least 85 percent of $f'c$ and if no single core is less than 75 percent of $f'c$. Locations represented by erratic core strengths shall be retested. Remove concrete not meeting strength criteria and provide new acceptable concrete. Repair core

holes with nonshrink grout. Match color and finish of adjacent concrete.

4. Air Content: ASTM C173 or ASTM C231. Test air-entrained concrete for air content at the same frequency as specified for slump tests.

5. Post-Installed Anchors

A. Testing: 25 of each type and size of drilled-in anchor shall be proof loaded by the independent testing laboratory. Adhesive anchors and capsule anchors shall not be torque tested. If more than 10% of the tested anchors fail to achieve the specified torque or proof load within the limits as defined on the Drawings, all anchors of the same diameter and type as the failed anchor shall be tested.

1) Tension testing should be performed in accordance with ASTM E488.

2) Torque shall be applied with a calibrated torque wrench.

3) Proof loads shall be applied with a calibrated hydraulic ram. Displacement of adhesive and capsule anchors at proof load shall not exceed $D/10$, where D is the nominal anchor diameter.

B. Minimum anchor embedments, proof loads and torques shall be as shown on the Drawings.

3.08 REPAIR, REHABILITATION AND REMOVAL

A. Prior to final acceptance, inspect the structure for cracks, damage and substandard concrete placements that may adversely affect the service life of the structure. Submit a report documenting these defects, which includes recommendations for repair, removal and/or remediation to the Architect for concurrence before any corrective work is accomplished. Perform corrective measures required.

1. Crack Repair: Prior to final acceptance, document and repair all cracks in excess of 0.02 inches wide. Submit the proposed method and materials to repair the cracks to the Architect for concurrence. Address the amount of movement expected in the crack due to temperature changes and loading. Perform corrective measures required.

B. Post-Installed Anchors: Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.

END OF SECTION

CAST-IN-PLACE CONCRETE (STRUCTURAL)

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SECTION 03412 - PRECAST PRESTRESSED CONCRETE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. The work includes the provision of precast, prestressed concrete herein referred to as prestressed members. Prestressed members shall be the product of a manufacturer specializing in the production of precast prestressed concrete members. In the ACI publications, the advisory provisions shall be considered to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears; reference to the "Building Official," the "Structural Engineer" and the "Architect/ Engineer" shall be interpreted to mean the Architect.

1.02 RELATED WORK SPECIFIED ELSEWHERE
(NOT USED)

1.03 SUBMITTALS

- A. Contractor Furnished Design: ACI 318 and the PCI Design Handbook. Unless otherwise indicated, design prestressed members (including connections) for the design load conditions and spans indicated, and for additional loads imposed by openings and supports of the work of other trades. Design prestressed members for handling without cracking in accordance with the PCI Design Handbook. Prestressed members shall have a fire rating of 1-hour as indicated in accordance with UL Fire Resistance Directory, or as designed in accordance with PCI MNL-124. Design calculations and shop drawings of prestressed members (including connections) shall be prepared and sealed by a registered professional engineer, and submitted for approval prior to fabrication. Submit calculations for volume change as part of the design calculations.
- B. Shop Drawings: Provide shop drawings indicating complete information for the fabrication, handling, and erection of the prestressed member. Shop drawings shall not be reproductions of contract drawings. The drawings shall indicate, as a minimum,

the following information:

1. Marking of members for erection;
 2. Connections for work of other trades;
 3. Connections between members, and connections between members and other construction;
 4. Location and size of openings which cut prestressing strands, or require the relocation of prestressing strands to be cast in the member;
 5. Headers for openings;
 6. Joints between members, and joints between members and other construction;
 7. Reinforcing, including prestressing steel details;
 8. Schedule and sequence of tensioning and detensioning prestressing strands;
 9. Material properties of steel and concrete used;
 10. Lifting and erection inserts;
 11. Dimensions and surface finishes of each member;
 12. Estimated camber;
 13. Erection sequence and handling requirements;
 14. All loads used in design (such as live, dead, handling, and erection);
 15. Bracing/shoring required.
- C. Contractor Mix Design: Thirty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Include a complete list of materials including type; brand; source and amount of cement, pozzolan, and admixtures; and applicable reference specifications. Provide results of pozzolan tests performed within 6 months of submittal date. Provide copies of test reports showing that the mix has been successfully tested to produce concrete with the properties specified and will be suitable for the job conditions. Obtain approval before concrete placement.
- D. Certification of Materials: ASTM C 94. Provide mandatory batch ticket information for each load of ready-mixed concrete.
1. Certificates of Compliance:
 - a. Aggregates
 - b. Admixtures
 - c. Reinforcement (including prestressing steel)

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- d. Weldability of reinforcing
- e. Cement
- f. Pozzolan
- 2. Catalog Data:
 - a. Materials for curing concrete
 - b. Joint sealing materials
 - c. Anchorage and lifting inserts and devices
- E. Quality Control Procedures: Submit procedures established in accordance with PCI MNL-116 by the prestressing manufacturer.

1.04 FABRICATION, SAMPLING, AND TESTING

- A. PCI MNL-116. At the prestressor's option, in lieu of core samples, ACI 318 full scale load tests may be performed. Perform on randomly selected members, as directed by the Architect.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Lift and support prestressed members at the lifting and supporting points indicated on the shop drawings. Store prestressed members off the ground. Separate stacked prestressed members by battens across the full width of each bearing point. Protect from weather, marring, damage, and overload.

PART 2 PRODUCTS

2.01 CONCRETE

- A. ACI 318, for Contractor furnished mix design. The minimum compressive strength of concrete at 28 days shall be 6000 psi, unless otherwise indicated. Add air-entraining admixtures at the mixer to produce between 4 and 6 percent air by volume.

2.02 MATERIALS

- A. Cement: ASTM C 150, Type I, or Type II, or ASTM C 595, Type IP(MS) blended cement, except as modified herein. The blended cement shall consist of a mixture of ASTM C 150 cement and one of the following materials: ASTM C 618 pozzolan or fly ash, or ASTM C 989 ground iron blast furnace slag. The pozzolan/fly ash content shall not exceed 25 percent and the ground iron blast furnace slag shall not exceed 50 percent by weight of the total cementitious

PRECAST PRESTRESSED CONCRETE

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material. For exposed concrete, use one manufacturer for each type of cement, ground slag, fly ash, and pozzolan.

1. The following mix design for cement shall be used: Lehigh White Cement - 470 lb., Gray Cement type 1 - 235 lbs., Mason Sand - 1410 lb.
 2. Fly Ash and Pozzolan: ASTM C 618, Type N, F, or C, except that the maximum allowable loss on ignition shall be 6 percent for Type N and F. Add with cement.
 3. Ground Iron Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Water: Water shall be fresh, clean, and potable.
- C. Aggregates: ASTM C 33, Size 57 except as modified herein. Obtain aggregates for exposed concrete surfaces from one source. Aggregates shall not contain any substance which may be deleteriously reactive with the alkalis in the cement.
- D. Nonshrink Grout: COE CRD-C-621.
- E. Admixtures:
1. Air-Entraining: ASTM C 260.
 2. Accelerating: ASTM C 494, Type C or E.
 3. Water Reducing: ASTM C 494, Types A, E, or F.
- F. Reinforcement:
1. Reinforcing Bars: ASTM A 615, Grade 60, including supplementary requirement S1 with the bars marked S; ASTM A 617 with the bars marked A, Grade 60; or ASTM A 616 with the bar marked R, Grade 60.
 2. Welded Wire Fabric: ASTM A 185 or ASTM A 497.
 3. Spiral Wire: ASTM A 82.
 4. Prestressing Strands:
 - a. Seven Wire Stressed Relieved: ASTM A 416 or ASTM A 416 with supplement for low relaxation wire.
- G. Elastomeric Bearing Pads: AASHTO HB-13, for plain neoprene bearings.

2.03 FABRICATION

- A. PCI MNL-116, unless specified otherwise.
- B. Forms: Brace forms to prevent deformation. Forms shall produce a smooth, dense surface. Chamfer exposed edges of columns and beams 3/4 inch, unless otherwise indicated. Provide threaded or snap-off

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- type form ties.
- C. Reinforcement Placement: ACI 318 for placement and splicing. Reinforcement may be preassembled before placement in forms. Provide exposed connecting bars, or other approved connection methods, between prestressed and cast-in-place construction. Remove any excess mortar that adheres to the exposed connections. Provide curvature or drape of the prestressing strands using approved hold-down devices.
 - D. Inserts: When the ends of the prestressed member will be exposed, recess the prestressing strands using inserts. After detensioning, remove inserts and fill the recess with nonshrink grout.
 - E. Concrete:
 - 1. Concrete Mixing: ASTM C 94. Mixing operations shall produce batch-to-batch uniformity of strength, consistency, and appearance.
 - 2. Concrete Placing: ACI 304, ACI 305 for hot weather concreting, ACI 306 for cold weather concreting, and ACI 309, unless otherwise specified.
 - 3. Concrete Curing: Commence curing immediately following the initial set and completion of surface finishing. Provide curing procedures to keep the temperature of the concrete between 50 and 190 degrees F. When accelerated curing is used, apply heat at controlled rate and uniformly along the casting beds. Monitor temperatures at various points in a product line in different casts.
 - F. Prestressing: Do not transfer prestressing forces during detensioning until the concrete has reached a minimum compressive strength of 3500 psi, unless a higher strength is required by the Contractor furnished design.
 - G. Surface Finish: Repairs to honeycombed sections located in a bearing area shall be approved by the Architect prior to repairs. Prestressed members which contain honeycombed sections deep enough to expose prestressing strands shall be rejected. Prestressed members containing hairline cracks which are visible and are less than 0.02 inches in width, may be accepted. However, prestressed members which

contain cracks greater than 0.02 inch in width shall be approved by the Architect. When approved, the member shall be repaired. Any prestressed member that is structurally impaired shall be rejected.

1. Unformed Concealed Surfaces (Standard Smooth Finish): Provide a trowel finish. Level surface with a straightedge and strike off. After surface water has disappeared, float and trowel surface. Provide smooth finished surface free of trowel marks and uniform in texture and appearance.
2. Smooth, Exposed-to-View Interior Surfaces: Provide a standard smooth finish to all exposed-to-view surfaces of panels, unless otherwise indicated. Provide a concrete surface having the texture imparted by steel trowel suitable for painting.
3. Exterior finish: Provide for exterior surfaces of panels, including chamfers, edges, recesses and projections unless otherwise indicated. Sandblast to finish of the approved surface finish sample. Sandblast all panels to achieve uniform color and texture.

PART 3 EXECUTION

3.01 SURFACE FINISHES

- A. Prior to erection, and again after installation, prestressed members shall be checked for damage, such as cracking, spalling, and honeycombing. As directed by the Architect, prestressed members that do not meet the surface finish requirements specified in Part 2 in paragraph titled, "Surface Finish" shall be repaired, or removed and replaced with new prestressed members.

3.02 ERECTION

- A. PCI Manual 116, except as specified otherwise for lifting, transporting and placing members. Prestressed members shall be erected after the concrete has attained the specified compressive strength, unless otherwise approved by the prestressing manufacturer. In addition, prestressed members shall not be rigidly fixed in position until

the prestressed member has "aged" 90 days after detensioning. Erect in accordance with the approved shop drawings. Brace prestressed members, unless design calculations submitted with the shop drawings indicate bracing is not required. Follow the manufacturer's recommendations for maximum construction loads. Place prestressed members level, plumb, square, and true within tolerances. Align member ends. After erection, remove lifting loops, recess 1/2-inch minimum and fill with non-shrink grout. Connect precast to steel or cast-in-place concrete as recommended in PCI Design Handbook, or as otherwise indicated.

3.03 WELDING

- A. AWS D 1.4 for welding connections and reinforcing splices. Do not weld prestressing strands. Protect the concrete and prestressing strands from heat during welding.

3.04 BEARING SURFACES

- A. Shall be flat, free of irregularities, and properly sized. Size bearing surfaces to provide for the indicated clearances between the prestressed member and adjacent prestressed members or adjoining field placed surfaces. Correct bearing surface irregularities with nonshrink grout. Provide bearing pads where indicated or required. Do not use hardboard bearing pads. Place prestressed members at right angles to the bearing surface, unless indicated otherwise, and draw-up tight without forcing or distortion, with sides plumb.

3.05 OPENINGS

- A. Holes or cuts requiring prestressing steel to be cut, which are not indicated on the approved shop drawing, shall only be made with the approval of the Architect and the prestressing manufacturer. Drill holes less than 8 inches in diameter with a diamond tipped core drill.

3.06 GROUTING

- A. Clean and fill indicated keyways between prestressed members, and other indicated areas, solidly with

nonshrink grout or cementitious grout. Provide reinforcing where indicated. Remove excess grout before hardening.

END OF SECTION 03412

SECTION 03.450 ARCHITECTURAL PRECAST CONCRETE (CAST STONE)

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes the performance criteria, materials, production, and erection of architectural precast concrete for the entire project. The work performed under this section includes all labor, material, equipment, related services, and supervision required for the manufacture and erection of the architectural precast concrete work shown on the contract drawings. This Project requires Wet Cast Product, Dry-Tamp product will not be accepted.
- B. This Section includes the following:
 - 1. Architectural precast concrete cladding units and columns.
 - 2. 6'-0" diameter Alcorn State University logo.
 - 3. Other precast concrete items as indicated on Drawings.
- C. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete".
 - 2. Division 5 Section "Cast in Place Stair Nosings"
 - 3. Division 7 Section "Flashing and Sheet Metal" for flashing receivers and reglets.
 - 4. Division 7 Section "Joint Sealants".

1.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - 1. Dead Loads: panel weight and all materials that bear on them.
 - 2. Live Loads: see Drawings.
 - 3. Wind Loads: see Drawings.
 - 4. Seismic Loads: see Drawings.
 - 5. Project Specific Loads: see Drawings
 - 6. Design framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live load deflection, shrinkage and creep of primary building structure, and other building movements as indicated on Structural Drawings.

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7. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of 80 deg F. Use other values, greater or smaller, whenever justified by climatic conditions at the project site.
8. Fire Resistance Rating: provide fire resistance ratings where indicated on Drawings.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Retain quality control records and certificates of compliance for 5 years or period of warranty, whichever is greater.
- B. Design Mixes: For each concrete mix along with compressive strength and water-absorption tests.
- C. Shop (Erection) Drawings: Detail fabrication and installation of architectural precast concrete units. Indicate member locations, plans, elevations, dimensions, shapes and cross sections. Indicate aesthetic intent including joints, reveals, and extent and location of each surface finish. Indicate details at building corners.
 1. Indicate separate face and backup mix locations, and thicknesses.
 2. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, and connections.
 3. Indicate locations, tolerances and details of anchorage devices to be embedded in or attached to structure or other construction.
 4. Indicate locations, extent and treatment of dry joints if two-stage casting is proposed.
 5. Indicate plans, and/or elevations showing unit location, and sequence of erection for special conditions.
 6. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
 7. Indicate relationship of architectural precast concrete units to adjacent materials.
 8. Indicate locations and details of stone facings, stone anchors, and joint widths.

9. Design Modifications
 - a. If design modifications are necessary to meet the performance requirements and field conditions, submit design calculations and drawings. Do not adversely affect the appearance, durability or strength of units when modifying details or materials and maintain the general design concept.
10. Comprehensive engineering design signed and sealed by the qualified professional engineer responsible for its preparation registered in the state of Mississippi. Show governing panel types, connections, and types of reinforcement, including special reinforcement. Coordinate the location, type, magnitude and direction of all imposed loadings from the precast system to the building structural frame with the Engineer of Record.
 - D. Samples: submit samples for selection, approximately 12 by 12 by 2 inches, representative of finishes, color, and textures of exposed surfaces of architectural precast concrete units.
 1. When back face of precast concrete unit is to be exposed, show samples of the workmanship, color, and texture of the backup concrete as well as the facing.
 - E. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 1. Concrete materials.
 2. Reinforcing materials and prestressing tendons.
 3. Admixtures.
 4. Bearing pads.
 5. Structural-steel shapes and hollow structural sections.
 - F. Welding Certificates: Copies of certificates for welding procedure specifications (WPS) and personnel.
 - G. Qualification Data: Include list of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.04 QUALITY ASSURANCE

A. Erector Qualifications

1. A precast concrete erector Qualified by the Precast/Prestressed Concrete Institute (PCI) prior to beginning work at the project site.

B. Fabricator Qualifications: A firm that complies with the following requirements and is experienced in producing architectural precast concrete units similar to those indicated for this Project and with a record of successful in-service performance.

1. Assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

2. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of architectural precast concrete that are similar to those indicated for this Project in material, design, and extent.

3. Participates in PCI's Plant Certification program at the time of bidding and is designated a PCI-certified plant for Group A, Category A1-Architectural Cladding and Load Bearing Units.

4. Has sufficient production capacity to produce required units without delaying the Work.

C. Testing Agency Qualifications: An independent testing agency, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

D. Design Standards: Comply with ACI 318 (ACI 318M) and the design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.

E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual

for Quality Control for Plants and Production of Architectural Precast Concrete Products."

- F. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel"; and AWS D1.4, "Structural Welding Code - Reinforcing Steel."
- G. Calculated Fire-Test-Response Characteristics: Where indicated, provide architectural precast concrete units whose fire resistance has been calculated according to PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete," and is acceptable to authorities having jurisdiction.
- H. Mock-up: After sample approval and before fabricating architectural precast concrete units, produce a minimum of two sample panels approximately 16 square feet in size for review by Architect. Incorporate full scale details of architectural features, finishes, textures, and transitions in the sample panels - including coping detail.
 - 1. Locate panels where indicated or, if not indicated, as directed by Architect.
 - 2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
 - 3. After acceptance of repair technique, maintain one sample panel at the manufacturer's plant and one at the project site in an undisturbed condition as a standard for judging the completed Work.
 - 4. Demolish and remove sample panels when directed.
- I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings".

1.05 DELIVERY, STORAGE AND HANDLING

- A. Store units with adequate support and bracing and protect units to prevent contact with soil, staining, and to prevent cracking, distortion, warping or other physical damage.
- B. Store units, unless otherwise specified, with non-staining, resilient supports.
- C. Place stored units so identification marks are clearly visible, and product can be inspected.
- D. Deliver all architectural precast concrete units to the project site in such quantities and at such times

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to assure compliance with the agreed project schedule and proper setting sequence so as to limit unloading units temporarily on the ground.

- E. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses which would cause cracking or damage.
- F. Lift and support units only at designated points shown on the Shop Drawings.
- G. Place non-staining resilient spacers of even thickness between each unit.
- H. Support units during shipment on non-staining shock absorbing material.

1.06 SEQUENCING

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 PRODUCTS

2.01 PRECAST MANUFACTURER

- A. Gate Precast Company
- B. Jackson Precast, Inc.
- C. ConArt, Inc
- D. Metromont Corporation
- E. Columbia Precast

2.02 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, nonabsorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; non-reactive with concrete and suitable for producing required finishes.
 - 1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.
- B. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Provide solid backing and form supports to ensure that form

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liners remain in place during concrete placement. Use with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

2.03 REINFORCING MATERIALS

- A. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- B. Steel Bar Mats: ASTM A 184/A 184M, assembled with clips, as follows:
 - 1. Steel Reinforcement: ASTM A 706/A 706M, deformed bars.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- E. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.04 PRESTRESSING TENDONS

- A. Prestressing Strand: ASTM A 416/A 416M, Grade 270 (Grade 1860), uncoated, 7-wire, low-relaxation strand.
- B. Unbonded Post-Tension Strand: ASTM A416/A416M with corrosion inhibitor conforming to ASTM D1743, Grade 270 (Grade 1860), 7-wire, low-relaxation strand with polypropylene conduit sheath.

2.05 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type I or III.
 - 1. For surfaces exposed to view in finished structure, use white, same type, brand, and mill source throughout the precast concrete production.
 - 2. Standard gray Portland cement may be used for non-exposed backup concrete.
- B. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S. Provide and stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for entire project.

- C. Lightweight Aggregates: Except as modified by PCI MNL 117, ASTM C 330 with absorption less than 11 percent.
- D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
- E. Water-Reducing Admixture: ASTM C 494/C494M, Type A.
- F. Retarding Admixture: ASTM C 494/C494M, Type B.
- G. Water-Reducing and Retarding Admixture: ASTM C 494/C494M, Type D.
- H. High-Range, Water-Reducing Admixture: ASTM C 494/C494M, Type F.
- I. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C494M, Type G.
- J. Plasticizing Admixture for Flowable Concrete: ASTM C 1017/C1017M.
- K. Admixtures containing calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture are not permitted.

2.06 STEEL CONNECTION MATERIALS

- A. General: Provide as specified herein as minimum requirements. Provide 314 stainless steel where exposed to potential moisture in cavity wall space.
- B. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M except silicon (Si) content in the range of 0 to 0.03% or 0.15 to 0.25% for materials to be galvanized. Steel with chemistry conforming to the formula $Si + 2.5P < 0.09$ is also acceptable.
- C. Carbon-Steel Headed Studs: ASTM A 108, Grades 1018 through 1020, cold finished and bearing the minimum mechanical properties for studs as indicated under MNL 117, Table 3.2.3.; AWS D1.1, Type A or B, with arc shields.
- D. Carbon-Steel Plate: ASTM A 283/A 283M.
- E. Malleable Iron Castings: ASTM A 47/A 47M. Grade 32510 or 35028.
- F. Carbon-Steel Castings: ASTM A 27/A 27M, Grade U-60-30 (Grade 415-205).
- G. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M except silicon (Si) content in the range of 0 to 0.03% or 0.15 to 0.25% for materials to be galvanized. Steel with chemistry conforming to the formula $Si + 2.5P < 0.09$ is also acceptable.

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- H. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.
- I. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).
- J. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.
- K. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6) carbon-steel, hex-head bolts and studs; carbon-steel nuts (ASTM A563/A563M, Grade A); and flat, unhardened steel washers (ASTM F844).
- L. High-Strength Bolts and Nuts: ASTM A 325/A 325M or ASTM A490/A490M, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, (ASTM A563/A563M) and hardened carbon-steel washers (ASTM F436/F436M).
- M. Shop-Primed Finish: Prepare surfaces of non-galvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 1 followed by SSPCSP 3 and shop-apply SSPC-Paint 25 according to SSPC-PA 1.
- N. Welding Electrodes: Comply with AWS standards.

2.07 BEARING PADS AND OTHER ACCESSORIES

- A. Provide bearing pads for architectural precast concrete units to suit Project. Fabricator shall coordinate selection with Architect prior to fabrication.
- B. Reglets: Reglets and flashing are specified in Division 7 Section "Flashing and Sheet Metal".
- C. Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.08 GROUT MATERIALS

- A. Sand-Cement Grout: Portland Cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144, or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of a consistency

suitable for application within a 30-minute working time.

- C. Joints between units shall be sealed with low-modulus, neutral cure silicone sealant and backer rod.

2.09 CONCRETE MIXES

- A. Prepare design mixes to match Architect's sample for each type of concrete required. Provide mixes for approval per the following:
 - 1. APC#1: match Indiana Limestone Company's "Select Gray".
- B. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
- C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 117 when tested in accordance with ASTM C1218/C1218M.
- D. Normal-Weight Concrete Face and Backup Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 117.
- F. Lightweight Concrete Backup Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi.
 - 2. Unit Weight: Calculated equilibrium unit weight of 115 lb/cu.ft., plus or minus 3 lb/cu.ft., according to ASTM C 567.
- G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- H. When included in design mixes, add other admixtures to concrete mixes according to manufacturer's written instructions.

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2.10 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement and vibration operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
 - 1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during placing of concrete. Coat form liner with form-release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Form joints are not permitted on faces exposed to view in the finished work.
 - 2. Edge and Corner Treatment: Uniformly chamfered.

2.11 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 - 1. Weld headed studs and deformed bar anchors used for anchorage according to AWS D1.1 and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on contract drawing.
- D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without approval of Architect.

- E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabrication, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy coated reinforcing exceeds limits specified ASTM A775/A775M repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 - 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 - 3. Place reinforcing steel and prestressing strand to maintain at least 3/4 -inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 - 4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses.
- G. Prestress tendons for architectural precast concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 117.
 - 1. Delay detensioning or post-tensioning of prestressed architectural precast concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under the same conditions as concrete member.
 - 2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting

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- tendons, using a sequence and pattern to prevent shock or unbalanced loading.
3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 4. Protect strand ends and anchorages with bituminous, zinc-rich or epoxy paint to avoid corrosion and possible rust spots.
- H. Mix concrete according to PCI MNL 117 and requirements in this Section. After concrete batching, no additional water may be added.
- I. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 117 for measuring, mixing, transporting, and placing concrete.
1. Place backup concrete to ensure bond with face mix concrete.
- J. Thoroughly consolidate placed concrete by internal and/or external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 117.
1. Place self-consolidating concrete without vibration in accordance with PCI Interim Guidelines for the Use of Self-Consolidating Concrete.
- K. Comply with ACI 306.1 procedures for cold-weather concrete placement.
- L. Comply with ACI 305R recommendations for hot-weather concrete placement.
- M. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that will not show in finished structure.
- N. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until the compressive strength is high enough to ensure that

stripping does not have an effect on the performance or appearance of the final product.

- O. Repair damaged architectural precast concrete units to meet acceptability requirements of PCI MNL 117.

2.12 FABRICATION TOLERANCES

- A. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

2.13 FINISHES

- A. Panel faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved sample panels.
- B. Finish exposed top, bottom, and/or back surfaces of architectural precast concrete units by smooth steel-trowel finish.

2.14 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete also test and inspect according to PCI Interim Guidelines for the Use of Self-Consolidating Concrete.
- B. Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318 (ACI 318M) requirements for concrete strength.
- C. Testing: If there is evidence that the concrete strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, Precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C42M.
 - 1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Architect.
 - 2. Cores will be tested in an air-dry condition.
 - 3. Strength of concrete for each series of 3 cores will be considered satisfactory if the average compressive strength is equal to at least 85

percent of the 28-day design compressive strength and no single core is less than 75 percent of the 28-day design compressive strength.

4. Test results will be made in writing on the same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports will include the following:

- a. Project identification name and number.
- b. Date when tests were performed.
- c. Name of precast concrete fabricator.
- d. Name of concrete testing agency.
- e. Identification letter, name, and type of precast concrete units or units represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

E. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mix that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

F. Defective Work: Architectural precast concrete units that do not comply with acceptability requirements in PCI MNL 117, including concrete strength, manufacturing tolerances, and color and texture range are unacceptable. Chipped, spalled or cracked units may be repaired, if repaired units match the visual mock-up.

1. The Architect reserves the right to reject any unit if it does not match the accepted samples and visual mock-up. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Deliver anchorage devices that are embedded in or attached to the building structural frame or foundation before start of such work. Provide

locations, setting diagrams, and templates for the proper installation of each anchorage device.

3.02 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Do not install precast concrete units until supporting cast-in place concrete building structural framing has attained minimum allowable design compressive strength or supporting steel or other structure is structurally ready to receive loads from precast.

3.03 ERECTION

- A. Install loose clips, hangers, bearing pads and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.
- B. Erect architectural precast concrete level, plumb and square within the specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
 - 1. Install temporary steel or plastic spacing shims or bearing pads as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting lifting devices and use sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast concrete surfaces when recess is exposed.
 - 4. Unless otherwise shown provide for uniform joint widths of 3/4 inch.
- C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on approved Erection Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and/or grouting are completed.

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1. Disruption of roof flashing continuity by connections is not permitted; concealment within roof insulation is acceptable.
- D. Welding: Comply with applicable AWS D1.1 and AWS D1.4 requirements for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.
 2. Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS.
 3. Clean weld affected metal surfaces with chipping hammer followed by brushing then re-prime damaged painted surfaces in accordance with manufacturer's recommendations.
 4. Visually inspect all welds critical to precast connections. Visually check all welds for completion and remove, reweld or repair all defective welds.
- E. At bolted connections, use lock washers, tack welding, or other acceptable means to prevent loosening of nuts after final adjustment.
1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For friction connection apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench.
- F. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

3.04 ERECTION TOLERANCES

- A. Erect architectural precast concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

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3.05 FIELD QUALITY CONTROL

- A. Testing: Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections.
- B. Field welds will be subject to visual inspections and non-destructive testing in accordance with ASTM E165 or ASTM E709.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Repair or remove and replace work that does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.06 REPAIRS

- A. Repairs will be permitted provided structural adequacy of units and appearance are not impaired.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.
- C. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- D. Remove and replace damaged architectural precast concrete units when repairs do not meet requirements.

3.07 CLEANING

- A. Clean all surfaces of precast concrete to be exposed to view, as necessary, prior to shipping.
- B. Clean mortar, plaster, fireproofing, weld slag, and any other deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean

- water. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION

SECTION 03.600 NON-SHRINK GROUTING

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Division 1 Sections

1.02 REFERENCES

CRD-C621 - Specification for Non Shrink Grout Packaged Dry, Hydraulic-Cement Grout.

ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).

ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

1.03 QUALITY ASSURANCE

A. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

1.04 SUBMITTALS

A. Refer to Structural Quality Assurance Plan in the Structural Drawings for additional submittal requirements.

PART 2 PRODUCTS

2.01 GROUT

A. Grout: Flowable, non-shrink, non-metallic in accordance with CRD-C-621 and ASTM C1107.

B. Compressive Strength: 5,000 psi minimum at 28 days.

2.02 WATER

A. Water: Clean, potable water.

PART 3 EXECUTION

3.01 HANDLING

A. Store and protect from moisture and contamination.

NON-SHRINK GROUTING

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- 3.02 PREPARATION
- A. Remove foreign materials including mud and dirt from areas to be grouted.
 - B. Use forms to contain grout. Forms shall be a minimum 1½ inch larger on all sides than the item grouted.
- 3.03 MIXING
- A. Mix grout to its fluid, self-leveling consistency in accordance with manufacturer's recommendations. Mix grout in a paddle-type mortar mixer; do not mix by hand.
 - B. Do not retemper grout. Do not exceed manufacturer's maximum limit on water content or use at a consistency that produces free bleeding.
- 3.04 PLACEMENT
- A. Consolidate to provide grout uniformity. Do not vibrate grout.
- 3.05 PROTECTION
- A. Protect grout and areas to be grouted from excessive heat and cold in accordance with manufacturer's Specifications. Protect grout from excessive drying shrinkage resulting from wind or direct sunlight. Protect areas grouted from excessive vibrations.

END OF SECTION

SECTION 04.220 CONCRETE UNIT MASONRY

PART 1 GENERAL

1.01 RELATED SECTIONS

- A. Division 1 Sections
- B. Section 03.200 - Concrete Reinforcing.
- C. Section 03.300 - Cast-in-Place Concrete.
- D. Section 04.810 - Unit Masonry.

1.02 REFERENCES

ACI 530.1-05/ASCE 6-05/TMS 602-05 - Specification for Masonry Structures.

ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.

ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.

ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens).

ASTM C140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.

ASTM C270 - Standard Specification for Mortar for Unit Masonry.

ASTM C404 - Standard Specification for Aggregates for Masonry Grout.

ASTM C476 - Standard Specification for Grout for Masonry.

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ASTM C1019 - Standard Test Method for Sampling and Testing Grout.

ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.

ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.

ASTM D2287 - Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.

1.03 SUBMITTALS

- A. Refer to Structural Quality Assurance Plan in Structural Drawings for additional submittal requirements.
- B. Submit coarse grout mix design.
- C. Shop Drawings: Submit for masonry reinforcement complying with Section 03.200.
- D. Submit procedures for construction of masonry walls to be filled with coarse grout. Procedures should include low lift grouting as applicable to Project.

1.04 QUALITY ASSURANCE

- A. Masonry construction and materials shall conform to all the requirements of ACI530.1/ASCE 6/TMS 602, except as modified by the requirements of the Construction Documents.
- B. Refer to the Structural Quality Assurance Plan in the Structural Drawings.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store materials in a dry condition to protect from elements and prevent contamination, deterioration, or damage due to moisture, temperature changes, contaminants, corrosion, and other causes.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY

A. Compressive Strength, f'm: See Structural Notes in the Structural Drawings.

2.02 CONCRETE MASONRY UNITS

A. Concrete masonry units: Comply with ASTM C90.

B. Weight: Lightweight.

C. Net Area Compressive Strength: As listed in Table 2 of ACI 530.1/ASCE 6/TMS 602 required for the specified f'm.

D. Face Dimensions: 16" long x 8" high nominal, unless indicated otherwise.

E. Special shapes: Where indicated on the Drawings.

2.03 MORTAR

A. Mortar: Type M or Type S in accordance with ASTM C270. Refer to Structural Drawings for locations.

B. Do not use admixtures that contain chlorides.

- 2.04 COARSE GROUT
- A. Coarse Grout: In accordance with ASTM C476.
 - B. Compressive Strength: See Structural Notes in the Structural Drawings.
 - C. Slump: 8 and 10 inches.
 - D. Do not use admixtures that contain chlorides.
- 2.05 WATER
- A. Water: Clean potable water free of deleterious substances.
- 2.06 REINFORCEMENT
- A. Horizontal and Vertical Reinforcing Bars: Comply with Section 03.200.
- 2.07 HORIZONTAL JOINT REINFORCEMENT
- A. Horizontal Joint Reinforcement: Manufactured with longitudinal, parallel, deformed side wires in accordance with ASTM A496 and of the size specified in the Structural Drawings. Cross wires shall be No. 9 gage, plain, in accordance with ASTM A82, unless noted otherwise in Structural Drawings.
 - B. Provide as a minimum, one side wire for each face shell of hollow masonry units. Provide additional side wires or eye sections for adjustable wall ties as specified for multiwythe wall construction.
 - C. Provide truss type joint reinforcement, except ladder type reinforcement shall be used for walls with vertical reinforcement.
 - D. Finish: Hot-dipped galvanized in accordance with ASTM A153, Class B-2.
 - E. Provide prefabricated corner and tee section accessories.
- 2.08 CONTRACTION JOINT MATERIAL
- A. Contraction joint material:
 - 1. Rubber shear keys complying with ASTM D2000, M2AA-805 and with a minimum durometer hardness of 80, or PVC shear keys complying with ASTM D2287, Type PVC 654-4 and with a minimum durometer hardness of 85.

PART 3 EXECUTION

3.01 PREPARATION

- A. Cold weather masonry construction shall comply with ACI 530.1, Section 1.8, Paragraph C when either of the following conditions exist:
 - 1. The ambient air temperature falls below 40 degrees Fahrenheit, or
 - 2. The temperature of masonry units is below 40 degrees Fahrenheit.
- B. Hot weather masonry construction shall comply with ACI 530.1, Section 1.8, Paragraph D when either of the following conditions exist:
 - 1. The ambient air temperature exceeds 100 degrees Fahrenheit, or The ambient air temperature exceeds 90 degrees Fahrenheit with a wind velocity greater than 8 mph.

3.02 CMU PLACEMENT

- A. Use dry masonry units. No frozen or wet units shall be used.
- B. Discard cracked, chipped, and spalled masonry units.
- C. Lay hollow units as follows:
 - 1. With full mortar coverage on horizontal and vertical face shells.
 - 2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, pilasters, and in walls where adjacent to cells or cavities to be filled with grout.
 - 3. For starting course on footings where cells are not to be grouted, spread out full mortar bed including area under cells.
 - 4. Maintain joint widths indicated, except for minor variations to maintain joint alignment. If not indicated, lay walls with 3/8 inch joints.
 - 5. Buttering corners of joints, deep or excess furrowing of mortar joints is not permitted.
- D. Lay units in running bond, unless noted otherwise in the Structural Drawings.
- E. Fully bond external corners of concrete masonry.
- F. Where non-loadbearing masonry partitions extend to underside of floor or structural system, stop masonry short as shown in the Structural Drawings to allow for live load deflection. See Architectural Drawings for gap filler material.

3.03 GROUT PLACEMENT

- A. Execute placement of grout in accordance with ACI 530.1, Section 3.5.
- B. Place coarse grout in maximum four-foot lifts, unless specifically approved in writing by the Architect/Structural Engineer.
- C. Do not fill reinforced cells with mortar.

3.04 MOVEMENT JOINTS

- A. Place expansion joints at locations indicated in the Structural Drawings.
 - 1. Do not run any horizontal reinforcing through expansion joints.
- B. Place contraction joints at locations indicated in the Structural Drawings.
 - 1. Install contraction joint material.
 - 2. Do not run horizontal reinforcement through contraction joints, except reinforcement in bond beams at floor and roof levels shall be continuous across contraction joints.

3.05 REINFORCEMENT

- A. Place reinforcing bars as indicated in the Structural Drawings and in accordance with ACI 530.1, Section 3.4.

3.06 HORIZONTAL JOINT REINFORCEMENT

- A. Place horizontal joint reinforcement in the horizontal mortar beds at spacings noted in the Structural Drawings and noted below.
- B. Place horizontal joint reinforcement above lintels and below sills at openings. Extend two feet beyond opening.
- C. Joint reinforcement shall be continuous. Lap joint reinforcement a minimum of 6 inches.

3.07 ERECTION BRACING

- A. Design, provide, and install temporary erection bracing during construction as required to stabilize erected masonry until complete structural system is constructed.

3.08 CLEANING AND POINTING

- A. Dry brush masonry surfaces before mortar has set hard to remove mortar crumbs and accumulation.

- B. Clean masonry with commercial brick cleaner approved by brick manufacturer. Protect other work from cleaning materials.
- C. Cut out defective mortar and repoint.

3.09 PROTECTION OF FINISHED WORK

- A. During erection cover top of wall, projections, and sills with strong waterproof membrane at end of each day's work.
 - 1. Extend and secure cover a minimum of 24 in. down both sides.
- B. Do not apply uniform floor or roof loading for at least 12 hours after placing masonry columns or walls.
- C. Do not apply concentrated loads for at least 3 days after building masonry columns or walls.

END OF SECTION

SECTION 04.810 UNIT MASONRY

PART 1 GENERAL

1.01 SUMMARY

- A. Extent of each type of masonry work is indicated on Drawings and Schedules.
 - 1. Face Brick, in standard size units, and custom shapes, or custom units as indicated.
 - 2. Concrete masonry units (CMU), as indicated on the Drawings.
 - 3. Colored brick mortar
 - 4. Anchors, ties, reinforcing, insulation, masonry accessories, and concealed flashings.
 - 5. Other items as specified herein or indicated on the Drawings.
- B. Related Sections include the following:
 - 1. Division 4 Section "Concrete Unit Masonry"
 - 2. Division 5 Section "Metal Fabrications" for steel lintels.
 - 3. Division 6 Section "Rough Carpentry"
 - 4. Division 7 Section "Vapor Barriers"
 - 5. Division 7 Section "Joint Sealants"

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Material Certificates: For each type and size of product indicated. For masonry units include data on material properties.
- C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- D. Shop Drawings
 - 1. For reinforcing steel. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

2. Flashing: show layout of flashing, including preformed corners and end dam locations.
- E. Samples: For verification purposes submit the following:
1. Manufacturer's complete and current product data for each different masonry unit, accessory, and other manufactured product indicated, including certifications that each item and type complies with specified requirements.
 - a. Include instructions for handling, storage, installation, and protection.
 2. Provide samples for initial selection purposes of the following:
 - a. Exposed masonry, showing full extent of colors and variations anticipated, for each standard and special shape unit.
 - b. After selection, provide a minimum of **50 brick** for Architect's control sample.

1.03

QUALITY ASSURANCE

- A. All work shall comply with the 2006 International Building Code (IBC 2006) and ACI 530.
- B. Job Mock-Up: Prior to installation of masonry work, erect sample wall panel mock-up at site using materials, bond and joint tooling required for final work. **INCLUDE LOOSE BRICK FROM APPROVED SAMPLE FOR COMPARISON.** Provide special features as directed, including all colors as indicated. Build mock-up at site, where directed, of full thickness and of size specified, indicating the proposed range for each color, texture and workmanship to be expected in the completed work. Obtain Architect's acceptance of visual qualities of the mock-up before start of masonry work. Retain mock-up during construction as a standard for judging completed masonry work. Do not alter, move or destroy mock-up until work is completed. Use sample panel to test proposed cleaning procedures. Provide mock-up panel for the following wall types:
 1. Typical exterior cavity wall composed of all types of facing brick and metal stud backup, typical storefront unit, and APC sill per Division 3 Section "Architectural Precast Concrete", 6-foot long x minimum 8-foot high (or higher as required) to include all components. Include all accessories as specified herein including but not

limited to thru wall flashing, drip plate, and mortar drip collector.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry materials to project in undamaged condition.
- B. Store and handle masonry units palleted, off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.
- C. Store cementitious materials and insulation off the ground, under cover, and in dry location.
- D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- E. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

1.05 PROJECT CONDITIONS

A. Protection of Masonry:

- 1. During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
- 2. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- 3. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after constructing masonry walls or columns.

C. Stain Prevention:

- 1. Prevent grout or mortar from staining the face of masonry to be left exposed. Remove immediately grout or mortar in contact with such masonry.
- 2. Protect installed face brick (and APC) at ground level from clay staining by maintaining a perimeter **3'-0" wide of sod as specified**, until final landscaping or other improvements indicated adjacent to completed masonry work are in place.
- 3. Protect sills, ledges and projections from droppings of mortar.

4. Protect surfaces of window and door frames as well as similar products with painted and integral finished from mortar droppings, and other damage.
- D. Clean Air Space: Prevent grout and mortar from occurring in, bridging, forming ledges, and/or filling air space between masonry and back up walls.
- E. Cold-Weather Construction: When the ambient temperature falls below 40 degrees (4 degrees Celsius) comply with provisions of ACI 530, Specification for Masonry, for cold-weather construction and the following:
 1. Do not lay masonry units that are wet or frozen.
 2. Remove masonry damaged by freezing conditions.
- F. Hot-Weather Construction: When the ambient temperature exceeds 90 degrees (32 degrees Celsius) comply with provisions of ACI 530, Specification for Masonry, for hot-weather construction.
- G. Protect plastic insulation from exposure to sunlight and against ignition. Schedule delivery so that installation and concealment may be performed as rapidly as possible.

PART 2 PRODUCTS

2.01 BRICK MATERIALS

- A. Face Brick General
 1. Obtain masonry units of each type from one manufacturer, of uniform texture and color.
 2. Size:
 - a. Standard Modular: 3 5/8 inches x 2 1/4 inches x 7 5/8 inches unless otherwise indicated.
 - b. Provide modular and as follows:
 - (1) For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - (2) Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
 3. Provide solid, uncored brick for all brick reveal areas, brick screen walls, and other areas indicated to receive "solid" brick.

B. Face Brick Schedule

1. Brick Type 1

- a. Assurance: Comply with ASTM C216, Grade SW, Type FBS.
- b. Provide as manufactured by Taylor Clay Products, Inc. (locally distributed by Boral Bricks). Approved comparable products by:
 - 1) Columbia Block & Brick
 - 2) Cherokee Brick & Tile Company

2.02 CONCRETE MASONRY UNITS

- A. Coordinate requirements with Division 4 Section "Concrete Unit Masonry"
- B. Size: Manufacturer's standard units with nominal face dimensions of 16" long x 8" high (15-5/8" x 7-5/8" actual), unless otherwise indicated. Thicknesses as indicated.
- C. Special Shapes: Provide where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.
- D. Standards: Hollow units comply with ASTM C90. Concrete brick comply with ASTM C55.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
- E. Curing: Cure units in a moisture-controlled atmosphere or in an autoclave at normal pressure and temperature to comply with ASTM C90. Limit moisture absorption during delivery and until time of installation to the maximum percentage specified for Type I units for the average annual relative humidity as reported by the U.S. Weather Bureau Station nearest the project site.
- F. Exposed Faces: Provide manufacturer's standard color and texture, unless otherwise indicated.

2.03 CONCRETE AND MASONRY LINTELS

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout.
- B. Provide and install loose lintels of steel and other materials where indicated.
 - 1. Steel lintels are specified in Division 5 Section "Metal Fabrications".

2.04 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Masonry Cement: ASTM C 91.
- D. Aggregate for Mortar: ASTM C 144.
- E. Aggregate for Grout: ASTM C 404.
- F. Water: Potable.

2.05 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime or masonry cement mortar unless otherwise indicated.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Concrete Masonry Units: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 - 1. Provide water repellent mortar admixture (equal to Grace Construction Products "DryBlock") to each batch of mortar.
 - 2. For masonry below grade or in contact with earth, use Type S.
 - 3. For reinforced masonry, use Type S.
 - 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type S.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, in not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 3000 psi.
 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.
- E. Mortar for Brick: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
1. For all face brick, use **Type N**.
 2. Brick Mortar Schedule:
 - a. Brick Mortar: manufacturer's colored mortar from one of the following manufacturer's:
 - (1) Holcim (US)
 - (2) CEMEX
 - (3) LaFarge North America
 - b. Provide water repellent mortar admixture (equal to Grace Construction Products "DryBrick") to each batch of mortar.

2.06 MASONRY ANCHORS AND TIES

- A. Provide accessories from one of the following manufacturers:
1. Hohmann & Barnard
 2. Dur-O-Wal (a Hohmann & Barnard Company)
 3. Wire-Bond
- B. Materials
1. Anchors and Ties: Carbon Steel: To ASTM A366, hot-dip galvanized after fabrication to ASTM A153, Class B.
 2. Wire: Carbon Steel: To ASTM A82, with zinc coating hot-dip galvanized after fabrication to ASTM A153.
 - a. Tensile Strength: Not less than 80,000 psi (552 MPa).
 - b. Yield Point: Not less than 70,000 psi (483 MPa).
 3. Seismic Reinforcement Retaining Clip: Rigid polyvinyl chloride clip to ASTM D1781, ASTM D2240, ASTM D638, ASTM D790, with ridge to secure continuous wire in mortar and 3 additional ridges to secure masonry wire tie.
 4. Anchor (and insulation) tape: Hohmann & Barnard's "X-Seal Transition Anchor Tape".
 - a. Provide at all locations where flexible anchors are secured thru to exterior sheathing substrate using mechanical devices (screws).

- b. 3 inch wide tape consists of a reinforced polyolefin base, laminated to a polypropylene layer. Adhesive-backed with removable release liner.
 - c. Manufactured from 45% post-industrial and/or post-consumer recycled material.
 - d. Apply in continuous lengths only.
 - e. Permeability:
 - (1) MVTR: ASTM E96 -B <.075 Perms¹
 - (2) Air permeability: TAPPI-460 >5000 Sec/100cc
- C. General
- 1. Tie length required to extend approximately 2 inches into masonry.
 - 2. Provide "Seismic Reinforcement Retaining Clips" at end of ALL pintles. Clip shall engage a 9 ga. continuous pencil rod.
- D. Continuous Wire Reinforcing for Masonry (Joint Reinforcement): Provide welded wire units prefabricated in straight lengths of not less than 10', with matching corner units. Fabricate from cold-drawn steel wire complying with ASTM A82, with deformed continuous side rods and plain cross-rods, and a unit width of 1 1/2" to 2" less than thickness of wall or partition. Provide units fabricated as follows:
- 1. Single Wythe Joint Reinforcement:
 - a. Ladder type fabricated with single pair of 9 ga. side rods and 9 ga. perpendicular cross-rods (standard weight):
 - (1) Hohmann & Barnard's "#220 Ladder-Mesh"
 - 2. Multi Wythe Adjustable Joint Reinforcement (Cavity Walls):
 - a. Ladder type fabricated with 3/16" side rods and 9 ga. perpendicular cross-rods (extra heavy weight weight) with welded eyes on the side rods:
 - (1) Hohmann & Barnard's "#270 S.I.S. Ladder Eye-Wire with Seismicclip® Interlock System"
 - b. Furnish with 3/16" adjustable pintles of lengths required for proper embedment in mortar joints, spaced 16" o.c.
- E. Flexible Anchors: Where masonry is indicated to be anchored to structural framework with flexible anchors, provide 2-piece anchors which will permit

horizontal and vertical movement of masonry, but will provide lateral restraint.

1. Anchored to metal studs with **no** rigid insulation:
 - a. Hohmann & Barnard's "DW-10HS Seismicclip® Interlock System" with "#VBT - Vee Byna-Tie".
 - (1) Provide ties in lengths as required.
 - b. Attach each anchor to wall with expansion anchor as recommended by the manufacturer.
2. Anchored to metal studs **with** rigid insulation:
 - a. Hohmann & Barnard's "X-Seal S.I.S. Anchor" with "#VBT - Vee Byna-Tie".
 - (1) Provide ties in lengths as required.
 - b. Attach each anchor to wall with expansion anchor as recommended by the manufacturer.
3. Anchored to concrete with rigid insulation:
 - a. Hohmann & Barnard's "#305 Dovetail Slot - 16 gauge" with "#315BT - Dovetail Vee Byna-Tie".
 - (1) Provide ties in lengths as required.

F. Intersections of Masonry Walls

1. Wire Mesh Ties
 - a. To be used at all intersections of exterior masonry walls with interior masonry partitions and where interior masonry partitions intersect with each other, except where noted to use joint stabilizing anchors below.
 - b. 1/2" mesh, 16 gage, hot-dip galvanized wire mesh, 12" long x 1" less than intersecting partition thickness.
 - (1) Hohmann & Barnard's "MWT - Mesh Wall Tie".
2. Joint Stabilizing Anchors:
 - a. Metal end piece with two integrated 9 gauge rods and a 4" long loose PVC "Slip-Tube"
 - (1) Hohmann & Barnard's "Slip-Set Stabilizer"
 - b. To be used at intersections of masonry walls at **all** control joint locations and where one of the intersecting masonry partitions is 8'-0" long or shorter. Install at 32 inches o.c. vertically.

G. Finish for Masonry Anchors and Ties

1. For interior locations, including devices which extend only into interior wythes of exterior masonry, fabricate from steel with mill galvanized finish complying with ASTM A641, Class 1 or 3; or hot-dip coating complying with ASTM A153, Class B-2.

2. For devices which extend into exterior wythe, fabricate from steel with hot-dip galvanized coating, ASTM A153, Class, B-2.

2.07 ACCESSORIES

A. Miscellaneous Anchors

1. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:
 - a. Headed bolts.
 - b. Nonheaded bolts, bent in manner indicated.
2. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - a. Type: Expansion anchors.
 - b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
 - c. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
 - d. For Postinstalled Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

B. Flashing for Masonry (Thru-Wall Flashing):

1. See WP#2 specified in Section 07.260
2. Drip Plate: 26 gauge, type 304 stainless steel with continuous 1/8 inch foam strip
 - a. Hohmann & Barnard's "FTS"
3. Compressible Filler Pad: 3/8" closed cell neoprene sponge equal to Hohmann & Barnard's #NS.

C. Mortar Drip Collector

1. A fluid conducting, non-absorbant, mold and mildew resistant polymer mesh designed to prevent weephole blockage. Trapezoidal shaped, formed at unequal heights.
 - a. "Mortar Net with Insect Barrier" as manufactured by Mortar Net USA or approved equal.

- b. Material to be 10" tall x 5'-0" long x as thick as the manufacturer recommends for the air space shown in which the drip collector is being installed.
- D. Weephole Vents
 - 1. UV stable, 90% open recycled polyester mesh weephole vents between units in the weep course.
 - a. "Mortar Net Weep Vents" as manufactured by Mortar Net USA or approved equal.
 - b. Architect to select color from manufacturer's full line of colors to match mortar color as specified herein.
- E. Weep Tubes
 - 1. "Round Plastic Weep Holes with Wick and Screen"; Sandell Construction Solutions
 - a. Provide at APC locations only - all others to receive "Weephole Vents" as specified herein.
- F. Miscellaneous Masonry Accessories
 - 1. Reinforcing Bars: Deformed steel, ASTM A615, Grade 60 of the sizes shown.
 - 2. Premolded Control Joint Strips: Solid rubber strips with a shore A durometer hardness of 60 to 80, designed to fit standard sash block and maintain lateral stability in masonry wall, size and configuration as indicated.
 - a. Hohmann & Barnard's "RS Series -Rubber Control Joint"
 - 3. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
 - 4. Brick Cleaner: Prosoco "Sure Klean 600" or approved equal. Cleaners containing muriatic acid will not be accepted.
 - a. Manufacturer to confirm in writing that cleaner will not affect texture or color of brick.
- G. Cavity Insulation Board
 - 1. Extruded polystyrene plastic board insulation, ASTM C578. Rigid closed-cell, with 25 psi compressive strength; 1.0% maximum water absorption; manufacturer's standard lengths and widths, thickness as indicated on Drawings, 4 x 8 foot sheets scored 16 and 24 inches on center.
 - a. R-5 per inch minimum.
 - b. Furnish "Styrofoam Brand Scoreboard" as manufactured by The Dow Chemical Co., "Foamular 150" as manufactured by Owens Corning or equal.

- c. Insulation tape for ALL joints shall be the same as "Anchor Tape" as specified herein.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Thickness: Build masonry construction to the actual thickness indicated. In most cases floor plan dimensions indicate nominal thickness and require deducting 3/8 inch to determine actual thickness.
- B. Build chases and recesses as shown and as required for the work of other trades. Provide not less than 8" of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.
- C. Miter corners of soldier and rowlock courses and bond mitered pieces together with thin set mortar formulated for use with brick in exterior locations.
- D. Layout walls in advance for accurate spacing of surface bond patterns, with uniform joint widths and to properly locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half size units at corners, jambs and wherever possible at other locations.
 - 1. Layout concrete masonry to provide equal cuts at each end of individual wall panels where practicable.
 - 2. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces concealed.
- E. Stopping and Resuming Work: Rack back 1/2-masonry unit length in each course of running bond; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if specified to be wetted), and remove loose masonry units and mortar prior to laying fresh masonry.
- F. Remove masonry units disturbed after placement; clean and set in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.
- G. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

- H. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.
1. Confirm with manufacturer prior to laying mock-up.

3.02 CONSTRUCTION TOLERANCES

A. Dimensions and Locations of Elements

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

C. Joints

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.03 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in **running bond**; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
 - 1. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of monofilament screen such as Dur-O-Wal's Dur-O-Stop in the joint below and rod mortar or grout into core.
- D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- E. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.04 MORTAR BEDDING AND JOINTING

- A. Batch Control
 - 1. Measure and batch materials either by volume or weight, such that the required proportions for mortar can be accurately controlled and maintained.
Measurement of sand exclusively by shovel will not be permitted. Use of a 1 cubic foot "box" is required. If "box" method is not used, portions of walls constructed will be considered non-conforming and be removed and replaced.
- B. Mix mortar using a mechanical mortar mixer to ensure homogeneity and workability. Hand mixing of the mortar is not permitted.
 - 1. Observe mixing times of 4 -5 minutes, consistent from batch to batch.
 - 2. Use clean, potable water, add the maximum amount consistent with optimum workability.
 - 3. Maintain a uniform water/cement ratio.

- C. Rinse out mixer following each batch.
 - 1. At the end of the day, thoroughly rinse the mixer to avoid contamination of future mortar batches.
- D. Do not use mortar which has begun to set, and discard if more than 2 1/2 hours has elapsed since initial mixing.
 - 1. Retemper mortar during this time by adding additional mixing water only to replace water lost due to evaporation.
 - 2. Do not retemper colored mortars.
- E. Lay hollow brick and CMU as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- F. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- G. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- H. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- I. Collar Joints: Fill joints between wythes of faced (composite) and solid walls solidly with mortar by pargeting either the back of the facing, or the face of the backing, and shove units solidly into pargeting.

3.05 CAVITY WALLS

- A. Coat cavity face of backup wythe to comply with Division 7 Section "Vapor Barriers"
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Bond wythes of cavity walls together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, spaced not to exceed 16 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 24 inches apart around perimeter of openings.
2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
- D. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
- E. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

3.06 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls, parapet walls and in all corner zones of the building. Corner zones are indicated on Structural Drawings.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
 1. Install joint stabilizing anchors not more than 32 inches o.c. at these locations.
- C. Provide continuity at corners by using prefabricated L-shaped units.

- 3.07 ANCHORING MASONRY TO CONCRETE
- A. Anchor masonry to concrete where masonry abuts or faces concrete to comply with the following:
1. Provide an open space not less than 2 inches wide between masonry and concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 3. Space anchors as indicated, but not more than 16 inches o.c. vertically and 16 inches o.c. horizontally.
- 3.08 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS
- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 2. At shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
 4. Install flashings with 6 inch minimum lap at splices. Bond to slab, and seal at penetrations and interruptions with mastic.
- C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
1. Use specified weep/vent products to form weep holes.
 2. Space weep holes 32 inches o.c. unless otherwise indicated.

3. Install a minimum of two weep hole inserts above openings less than 5'-4" wide.
- D. Place cavity drainage material in cavities per the following:
1. To prevent mortar bridging between the outer wythe and inner wall, install flashing extending from the bottom of the drainage material to at least 6" above the top of the drainage material.
 2. Lay the first one (1) or two (2) courses of brick at flashing level, then install drainage material continuously by placing it against the inside of the openings. No fasteners or adhesives are required.

3.09 REINFORCED UNIT MASONRY INSTALLATION

- A. Coordinate with Division 4 Section "Concrete Unit Masonry".
- B. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- C. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- D. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Low lifting grouting procedures shall be utilized for all masonry filled cell construction. Limit pour heights to a maximum of 48 inches and utilize a course grout mix.

3.10 CONTROL AND EXPANSION JOINTS

- A. Provide vertical expansion, control and isolation joints in masonry where indicated on Drawings. Build

in related masonry accessory items as the masonry work progresses. See Division 7 Sections "Joint Sealants".

- B. Expansion Joint Spacing: Place expansion joints where indicated on the drawings, but not more than 25'-0" on-center each way, and within 5'-0" of a corner.
 - 1. Confirm locations with Architect prior to installation.

3.11 PARGING

- A. Use a steel-trowel finish to produce a smooth, flat, dense surface. Form a wash at top of parging and a cove at bottom.
- B. Damp-cure parging for at least 24 hours and protect parging until cured.

3.12 FIELD QUALITY CONTROL

- A. Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:
 - 1. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
- B. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.
- C. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- D. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- E. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

3.13 REPAIR

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform

appearance, properly prepared for application of caulking or sealant compounds.

3.14 CLEANING OF BRICK

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. General
 - 1. **All cleaning methods are to be verified for compliance by the Architect prior to use.**
 - 2. Apply with a standard water hose nozzle. Apply using a circular application pattern and maintain an adequate and consistent distance. **PRESSURE WASHERS WILL NOT BE ALLOWED AS A MEANS OF APPLYING.**
- C. Pre-Cleaning
 - 1. Prior to cleaning brickwork, all large mortar droppings should be removed within 24 hours of laying with wood paddles or natural bristle brushes. Cleaning should begin 21 to 28 days with type N, after laying the brick.
- D. Cleaning
 - 1. Saturation: Thoroughly saturate all masonry with water before applying any cleaning product.
 - 2. Clean
 - a. Use a cleaning solution and procedure recommended by the brick manufacturer.
 - b. Apply the cleaning solution as recommended. The cleaning solution should remain on the brickwork 3 to 6 minutes before proceeding to the next step. Clean the brick starting at the top and working down, being sure to keep areas below the cleaning area saturated with water.
 - c. Do not allow the cleaning chemicals to dry on the brickwork.
 - 3. Rinse
 - a. Thoroughly rinse all masonry with water to remove the cleaning compound. It is vital that all chemicals used in cleaning be rinsed out of the brickwork before they dry in place.
 - b. Begin at the top of the brickwork and work down using two or three passes. Be certain all "dirty" water is flushed all the way to the ground and does not stay on the masonry.

3.15 CLEANING OF CMU

- A. Clean exposed CMU masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings. Rub joints with carborundum or CMU block to eliminate ridges and irregularities and provide well-formed intersections.

END OF SECTION

SECTION 05.120 STRUCTURAL STEEL

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Division 1 Sections.
- B. Division 3 Sections.
- C. Division 4 Sections.
- D. Section 05.500 - Metal Fabrications.
- E. Section 08.973 - Glass Canopy
- F. Section 09.990 - Painting.

1.02 REFERENCES

- A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.
- B. AISC 341 - Seismic Provisions for Structural Steel Buildings.
- C. AISC 360 - Specification for Structural Steel Buildings.
- D. AISC - Specification for Structural Joints Using ASTM A325 or A490 Bolts.
- E. ASTM A36 - Standard Specification for Carbon Structural Steel.
- F. ASTM A53 - Standard Specification for Pipe Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- G. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
- H. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- I. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength.
- J. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength.
- K. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 KSI Minimum Tensile Strength.
- L. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- M. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- N. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

- O. ASTM A992 - Standard Specification for Structural Steel Shapes.
- P. ASTM F436 - Standard Specification for Hardened Washers.
- Q. ASTM F844 - Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
- R. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105 KSI Yield Strength.
- S. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- T. AWS A5.1 - Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
- U. AWS A5.5 - Specification for Low-Allow Steel Electrodes for Shielded Metal Arc Welding.
- V. AWS A5.17 - Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding.
- W. AWS A5.20 - Specification for Carbon Steel Electrodes for Flux Cored Arc Welding.
- X. AWS D1.1 - Structural Welding Code.
- Y. AWS D1.3 - Structural Welding Code - Sheet Steel.
- Z. SSPC - Steel Structures Painting Council - Steel Structures Painting Manual.

1.03 SUBMITTALS

A. Shop Drawings

1. Shop drawings shall indicate the profiles, sizes, spacing, camber, ASTM grade and locations for all structural members, connections, attachments and fasteners. Include supplementary members and parts to complete the structural steel Work; Miscellaneous steel and angles for framed openings; Headed shear connectors.
2. Indicate welded connections with AWS welding symbols and include the weld length.

B. Mill Test Reports: Submit indicating structural strength and destructive and non-destructive test analysis.

C. Welder's Certificates: Submit Welder's Certificates which indicate that the welder has AWS qualifications for the intended Work within the previous 12 months.

1.04 QUALITY ASSURANCE

A. Comply with the applicable provisions of AISC 303, AISC 360 and AISC's "Specification for Structural Joints using ASTM A325 or A490 Bolts."

- B. Welding Work Qualifications: Qualify welders in accordance with the Standard Qualification Procedures as required by AWS D1.1.
- C. Provide ultrasonic testing reports for all complete penetration welds performed in the shop or field. Welds on steel trusses shall be tested by ultrasonic methods in the fabrication shop.
- D. Testing Laboratory Quality Assurance: All payments to inspectors and testing labs shall be made by the Contractor. Contractor shall coordinate and schedule in a timely manner with the Structural Testing/Inspection Agency to perform the following tests and inspections.
 - 1. Bolted Connections
 - a. Inspection shall be in accordance with AISC's "Specification for Structural Joints using ASTM A325 or A490 Bolts." Test a minimum of 10% of the bolted connections.
 - b. Inspect identification markings for conformance to ASTM standards specified in the Construction Documents.
 - c. Verify Manufacturer's Certificate of Compliance.
 - 2. Anchor Bolts
 - a. Verify anchor bolt size, configuration and embedment depth prior to the placement of concrete.
 - 3. Field Welded Connections
 - a. Verify Welder's Certifications.
 - b. Verify Identification markings of filler material for conformance with AWS specification in the Construction Documents.
 - c. Verify Manufacturer's Certificate of Compliance.
 - d. Inspection of welding shall be in compliance with the AWS welding code.
 - e. Visually inspect all field welded connections including periodic examination of fit-up.
 - f. Provide continuous inspection for: complete and partial penetration groove welds; multi-pass fillet welds; single pass fillet welds greater than 5/16"; plug and slot welds.
 - g. Provide periodic inspection for: single-pass fillet welds less than or equal to 5/16"; floor and roof deck welds.
 - h. Provide ultrasonic inspection for all complete penetration welds.

4. Inspection of steel frame joint details for compliance with the approved Construction Documents.
 - a. Details such as bracing and stiffening.
 - b. Member locations.
 - c. Application of joint details at each connection.

1.05 STORAGE

- A. Keep materials off the ground by using pallets, platforms or other support devices to provide protection against deleterious materials. Store to permit easy access for inspection and identification.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Structural Steel Members
 1. Wide Flange Steel Shapes: ASTM A992; 50 KSI minimum yield strength.
 2. Steel Angles, Channels, Plates and Bars: ASTM A36.
- B. Structural Tubing: ASTM 500, Grade B; 46 KSI minimum yield strength.
- C. Structural Steel Pipe: As indicated on the Structural Drawings:
 1. ASTM A53, Grade B, 35 KSI minimum yield strength.
 2. ASTM A500, Grade B, 42 KSI minimum yield Strength.
- D. Anchor Bolts: ASTM F1554, Grade 36; Headed bolt or a threaded rod with a heavy hexagonal nut and plate welded to the bottom of the threaded rod. Two hexagonal nuts and two plate washers conforming to ASTM A36 for each anchor bolt assembly.
- E. High Strength Fasteners
 1. High Strength Bolts: ASTM A325 or ASTM A490, galvanized to ASTM A123 for galvanized members. The locations for use of ASTM A490 bolts will be indicated on the Structural Drawings. 3/4" Diameter minimum, unless noted otherwise.
 2. Hardened Steel Washers: ASTM F436.
 3. Spline Type Tension Control Bolts: ASTM spline-type tension control bolts with plain hardened washers and suitable nuts are an acceptable alternate design bolt assembly.
 4. Load indicating washers shall not be used.
- F. Headed Studs: 3/4" diameter headed steel studs, unless indicated otherwise on the Drawings and

conforming to AWS D1.1 with heat-resistant ceramic arc shields.

- G. Welding Materials: AWS A5.1, A5.5, A5.17, or A5.20 E-70 series low hydrogen electrodes.
- H. Grout: Use a factory premixed grout consisting of cement, non-metallic aggregate, water reducing and plasticizing agents and requiring only water at the site; capable of developing a minimum compressive strength of 2,400 psi in 48 hours and 5,000 psi in 28 days.
- I. Shop and Touch-Up Primer: Free of lead and chromate and complies with State and Federal volatile organic compound (VOC) requirements; Compatible with finish coat; SSPC 15, Type 1, red oxide.
- J. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type I, Inorganic.

2.02 FABRICATION

- A. Fabricate according to AISC 360 and provide shop workmanship equal to the best modern practice conforming to listed industry standards and in accordance with the latest requirements of AISC.

2.03 FINISH

- A. Clean, prepare and shop prime structural steel members. Do not prime surfaces that will be in contact with concrete, areas to be field welded, surfaces of high strength bolts, surfaces to be galvanized or areas to receive special finishes.
- B. Prepare structural steel items scheduled to receive alkyd primer by SSPC-SP 2
- C. Galvanize to ASTM A123, structural steel members indicated on the Drawings. Provide a minimum of 1.25 oz./ sq. ft. zinc (hot-dipped galvanized) coating.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and ready to receive Work.

3.02 ERECTION

- A. Set structural steel accurately in the proper locations and to the elevations indicated and according to AISC 303 and AISC 360.
- B. Make provisions 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.
- C. Do not field cut or alter structural members in any manner without the approval of the Engineer.
 - D. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete. Use a primer that is consistent with the shop coat.
 - E. Install High-Strength Bolts in accordance with AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
 - F. Field weld components indicated on Drawings or shop drawings in accordance with AWS D1.1 or D1.3 as applicable.
 - G. After weld installation, grind all sight-exposed welds smooth and touch up with primer.
 - H. Immediately after erection, clean and apply paint matching shop primer to exposed field welds, bolted connections and other abraded areas.

3.03 ERECTION TOLERANCES

- A. Erection tolerances shall be as required by AISC.

END OF SECTION

SECTION 05.420 EXTERIOR STEEL STUD SYSTEM

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Division 1 Sections

1.02 REFERENCES

ASTM A446 - Standard Specification for Sheet Steel, Zinc-Coated (Galvanized) by Hot-Dip Process, Structural (Physical) Quality.

ASTM A525 - Standard Specification for General Requirements for Sheet Steel, Zinc-Coated (Galvanized) by Hot-Dip Process.

AWS D1.3 - Structural Welding Code: Sheet Steel.

AISI - Specification for the Design of Cold-Formed Steel Structural Members.

SSMA - Steel Stud Manufacturers Association Product Technical Information.

1.03 SUBMITTALS

A. Submit manufacturer's product information clearly describing quality, performance and finish for steel studs.

B. Submit design criteria prepared by the manufacturer/supplier for approval by the Architect/Structural Engineer. Design criteria shall include, but not be limited to the following:

1. Deflection of steel studs shall not exceed $L/600$.
2. Wind speed as indicated in Structural Notes.

C. Submit shop drawings prepared by manufacturer/supplier for approval by the Architect/Structural Engineer. These drawings should include the following:

1. Plans, cross-sections, or elevations as necessary to adequately depict component locations.
2. Connection details showing screw types and locations, weld lengths or other fastener requirements.

1.04 QUALITY ASSURANCE

- A. Manufacturer shall have a minimum of three years documented experience in the manufacturing of products required by the Contract Documents. Acceptable manufacturers are Dietrich Industries and Unimast Incorporated.
- B. Installer shall have a minimum of three years documented experience.
- C. Design framing system under the direct supervision of a professional structural engineer licensed in the state where the Project is located.
- D. Coordinate the placement of components within the stud framing system.

1.05 MOCKUP

- A. Provide a minimum of one mockup of exterior wall framing sufficient in size to illustrate various construction conditions and as directed by the Architect. Construct mock-up to include, but not be limited to, the following components:
 - 1. Stud framing, including runners, bridging, outlet box framing and other framing accessories. Include interior and exterior corner conditions, and intersections with interior rated stud walls.
 - 2. Typical window frame, door frame and expansion joint.
 - 3. Insulation, sheathing and vapor retarder. Install sheathing with veneer anchors to receive subsequent veneer mock-up.
- B. The approved sample will serve as the standard of quality, as well as for coordination with related components.
- C. Leave approved mock-up ready to received exterior insulation and finish system mock-up.
- D. Do not place mock-up to remain as a part of the Work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Studs and accessories which are 12, 14, or 16 gage shall meet the requirements of ASTM A446, Grade D with a minimum yield of 50,000 psi. Studs and accessories which are 18 or 20 gage shall meet the requirements of ASTM A446, Grade A with a minimum yield of 33,000 psi.

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- B. Studs and accessories shall have a G60 galvanized coating meeting the requirements of ASTM A525.
- C. Stud Size shall be determined by the stud manufacturer in accordance with Section 1.3 (B) (1), and loads per Structural Notes. Stud shall be the depth indicated in the Architectural Drawings.
- D. Substitution: Products of other manufacturers may be acceptable. Submit manufacturer literature for approval.

2.02 ACCESSORIES

- A. Bridging: 1-1/2-inch deep by 16 gage minimum.
- B. Strap Bracing: Minimum of 1-1/2-inch wide by 18 gage unless noted otherwise.
- C. Tracks: Deep leg type, unpunched, same gage, size, and finish as studs with minimum 18 gage thickness.
- D. Compensation Tracks/ Slip Tracks: Deep leg type with a flange width of 2-1/2 inch. Track shall be same nominal depth as stud/track with allowance for slip of standard deep leg track. Minimum 14 gage.
- E. Plates, Gussets, Clip Angles: Minimum 14 gage. Clip angles shall be a minimum of 2 inches x 2 inches.
- F. Self-drilling, Self-tapping Screws: Hot-dip galvanized conforming to values given in the referenced SSMA document.
- G. Anchorage Devices
 - 1. Powder Actuated Fasteners shall be manufactured from AISI 1062 or AISI 1065 steel austempered to a minimum core hardness of 50-54Rc and possess the following properties:
 - Tensile strength = 270,000 psi
 - Shear strength = 162,000 psiAll fasteners shall meet the requirements of ASTM B-633-78.
 - Fasteners shall be a minimum 9/64-inch diameter.
 - Fasteners shall be zinc plated.
 - Fastener minimum design values shall be in accordance with manufacturer's recommendations.
- H. Welding: AWS D1.3-8 Structural Welding Code-Sheet Metal (field welding of material shall not be permitted for 20 gage material or thinner).
- I. Acoustical Sealant: USG, or approved equal.
- J. Sizes and thicknesses are minimum acceptable, regardless of load. Actual sizes shall be determined by Steel Stud manufacturer in accordance with loads

given in the Structural Notes. Minimum listed size shall not be construed to be the actual designed component size.

PART 3 EXECUTION

3.01 ERECTION

A. General

1. Framing components shall be cut squarely for attachment to perpendicular members or, as required, for angular fit against abutting members.
2. Erect framing plumb, level, and square.
3. Studs shall be plumbed, aligned, and securely attached to the flanges or web of both the upper and lower tracks.
4. Fastening of components shall be with self-drilling screws or welds. Wire tying of components shall not be permitted. Touch-up field welds and scratched or damaged finish to studs with zinc rich paint.
5. Splices in framing components shall not be permitted other than in runner tracks.
6. Runner tracks shall be securely anchored to the supporting structure.

B. Studs Spacings: Stud manufacturer shall determine stud spacing at interior and corner zones to resist loads per the Structural Notes. Deflection criteria shall be in accordance with the Specifications. Corner zones shall be as defined in the Building Code. Stud spacing shall not exceed 16 inches, center-to-center, regardless of design loads.

C. Stud Tracks: Before installing stud tracks for exterior walls, apply two 1/2- inch round beads of acoustical sealant longitudinally under stud tracks to seal runner to floor.

D. Door Openings: Install multiple studs each side of door openings as required to resist design loads.

1. Install multiple studs horizontally between door jambs at top of doors as required to resist design loads.
2. On top of headers, install runners to receive bottom ends of studs over door openings.

E. Window Openings: Install multiple studs each side of window openings as required to resist design loads.

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1. Install multiple studs horizontally between window jambs to form sills and headers as required to resist design loads.
 2. Install multiple studs horizontally between window jambs to form sills and headers as required to resist design loads.
 3. On top of headers and bottom of sills, install runners to receive short studs.
 4. Attach wood blocking to stud framing with 1/2-inch diameter galvanized bolts 12 inches on-center. Coordinate attachment of window system to blocking/stud framing prior to erection of metal stud framing.
 5. Where indicated on the Structural Drawings (for example, at windows over 8 feet wide and at cantilevered parapets), attach studs / track to structural steel reinforcement with self-drilling screws.
- F. Corners: Construct using a minimum of three studs designed to resist the design loads.
- G. Between Studs: Install framing for attachment of electrical boxes, mechanical and for other items to be anchored to walls.
- H. At Butting Walls: Place studs not more than 2 inches from walls.
- I. Insulation: In all multiple jamb studs and multiple headers not accessible to insulation contractors, insulation equal to that specified elsewhere shall be provided.

END OF SECTION

EXTERIOR STEEL STUD SYSTEM

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SECTION 05421

PRE-ENGINEERED COLD-FORMED STEEL TRUSS SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pre-engineered cold-formed steel trusses.
- B. Cold-formed steel framing accessories.

1.02 REFERENCES

- A. AISI (American Iron and Steel Institute) - Specification for the Design of Cold-Formed Steel Structural Members, Latest Edition.
- B. ASTM A 370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
- C. ASTM A 500 - Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- D. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated by the Hot-Dip Process.
- E. AISI (American Iron and Steel Institute) - Design Guide for Cold-Formed Steel Trusses, Publication RG-9518, Latest Edition.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Design trusses for loading conditions indicated on Drawings.
 - 2. Design system components in accordance with AISI references.
 - 3. Conform to requirements of International Building Code, 2012.
 - 4. Maximum Allowable Deflection: 1/240th of span, under total design l loads.
 - 5. Maximum Allowable Deflection: 1/360th of span, under live design loads.
 - 6. Camber trusses to one-half the calculated dead load deflection.
- B. Performance Requirements: Truss system, with framing components and accessories, shall provide a complete horizontal framing system, ready for deck

- installation, meeting specified Design Requirements.
- C. Component Requirements
 - 1. Truss chord and web components shall be light gauge steel components.
 - 2. Truss chord and web components shall have rolled or closed edges to minimize the danger of cutting during handling. Chord and web components without rolled edges shall not be acceptable.

1.04 SUBMITTALS

- A. Submit as required by Architect.
- B. Product Data: Truss Component Manufacturer's descriptive literature for each item of cold-formed metal framing and each accessory specified in this section.
- C. Structural Calculations: Submit calculations by Registered Professional Engineer licensed in the State of Mississippi. List all design criteria for framing and connections.
- D. Shop Drawings: Truss Fabricator's drawings and / or details that
 - 1. Indicate special components and installations not fully detailed in product data.
 - 2. Indicate in the layout placement drawings the number, types, location, and spacings of trusses and other framing members.
 - 3. Indicate details of truss loading, reactions, uplifts, support locations, material sizes and gauges, permanent truss web bracing, and splices as required for a complete installation.
- E. Quality Assurance Submittals:
 - 1. Truss Component Manufacturer's Instructions: Printed installation instructions for each item of cold-formed metal framing and each accessory specified in this section.
 - 2. Design Data: Results of design analysis, bearing the seal and signature of a professional engineer registered in the State in which project is located.
- F. Truss Component Manufacturer's Recommendations for Handling and Storage: Observe written recommendations.

1.05 QUALITY ASSURANCE

- A. Pre-installation Meetings:

1. Confer at job site prior to scheduled beginning of construction activities of this section to review requirements of this section.
 2. Attendees: Representatives of the following:
 - a. Truss Fabricator, if requested by installer of products of this section.
 - b. Installer of this section.
 - c. Other entities directly affecting, or affected by, construction activities of this section, including but not limited to, the following:
 - 1) Installer of truss support framing.
 - 2) Installer of mechanical systems.
 - 3) Installer of electrical systems.
 3. Review potential interface conflicts; coordinate layout and support provisions.
- B. Regular job progress and coordination meetings, as required.

1.06 DELIVERY, STORAGE, AND HANDLING OF STEEL TRUSSES

- A. Packing, Shipping, Handling and Unloading: Handle and lift shop assembled units in accordance with Truss Component Manufacturer's recommendations to prevent damage or distortion.
- B. Storage and Protection: Store shop assembled units in accordance with Truss Component Manufacturer's recommendations to prevent damage, distortion and moisture buildup.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Truss Component Manufacturer for Pre-Engineered Cold-Formed Steel Truss System shall be a corporation that has been engaged in the manufacture of similar or larger projects for at least three years.

2.02 COMPONENTS

- A. Load Bearing Members: Mechanical properties of components shall be determined by testing conforming to ASTM A 370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products. Members shall be cold-formed to indicated sizes, profiles, and

thickness of steel conforming to ASTM A 653, minimum G60 coating, and ASTM A500 as follows:

1. Chord materials - Minimum yield strength 55,000 KSI.
 2. Web materials - Minimum yield strength 45,000 KSI.
 3. Shapes: Indicated on shop drawings.
 4. Size: Indicated on shop drawings.
 5. Gauge: Indicated on shop drawings.
- B. Fasteners Used in Fabricating Trusses: All web to chord connections shall be made with the appropriate screw fastener as recommended by the Truss Component Manufacturer. Each screw shall bear the stamp of the Truss Component Manufacturer for ready identification. Alternative fastening methods, such as welding, are not acceptable.

2.03 FABRICATION

- A. Pre-Engineered Cold-Formed Steel Trusses:
1. Shop fabricate from cold-formed steel components in accordance with shop drawings, using jiggling systems to ensure consistent component placement and alignment of components, and to maintain specified tolerances as shown in Section 2.4 below.
 2. Field fabrication of trusses is strictly prohibited unless performed by authorized TrusSteel Fabricator using the Fabricator's shop assemblers and proper jiggling systems.
- B. Shop fabrication of other cold-formed steel framing components into assemblies prior to erection is permitted; fabricate assemblies in accordance with shop drawings.
- C. Truss components shall be fastened as shown on the shop drawings.

2.04 SOURCE QUALITY CONTROL

- A. Material Tolerances: Steel for cold-formed chord components
1. Nominal 22 ga. members:
 - a. Minimum bare metal thickness: 0.0284 inch.
 - b. Maximum design thickness: 0.0299 inch.
 2. Nominal 20 ga. members:
 - a. Minimum bare metal thickness: 0.0329 inch.

- b. Maximum design thickness: 0.0346 inch.
 - 3. Nominal 18 ga. members:
 - a. Minimum bare metal thickness: 0.0428 inch.
 - b. Maximum design thickness: 0.0451 inch.
 - 4. Nominal 16 ga. members:
 - a. Minimum bare metal thickness: 0.0538 inch.
 - b. Maximum design thickness: 0.0566 inch.
 - B. Material Tolerances: Steel for cold-formed web components
 - 1. Nominal 20 ga. members:
 - a. Minimum bare metal thickness: 0.033 inch.
 - b. Maximum design thickness: 0.035 inch.
 - 2. Nominal 18 ga. members:
 - a. Minimum bare metal thickness: 0.047 inch.
 - b. Maximum design thickness: 0.049 inch.
 - 3. Nominal 16 ga. members:
 - a. Minimum bare metal thickness: 0.063 inch.
 - b. Maximum design thickness: 0.065 inch.
 - C. Materials Tolerances: Truss Assemblies: Fabricate to tolerances of maximum variation from plumb, level, or true to line as indicated below:
 - 1. Trusses up to 30 ft long = max 1/2 in. variation from design length
 - 2. Trusses over 30 ft. long = max 3/4 in. variation from design length
 - 3. Trusses up to 5 ft. high = max 1/4 in. variation from design height
 - 4. Trusses over 5 ft. high = max 1/2 in. variation from design height
 - D. Material Certification - Provide Truss Component Manufacturer's Material Certification.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 - 1. Verify that bearing surfaces and substrates are ready to receive steel trusses.
 - 2. Verify that rough-in utilities and/or chases that will interface with the steel trusses or truss bracing are in correct locations and do not interfere with truss placement.
- B. Installer's Examination:
 - 1. Have installer of this section inspect conditions

under which construction activities of this section are to be performed, then submit written notification if such conditions are unacceptable to installer.

2. Installer shall transmit two copies of installer's report to Architect within 24 hours of inspection.
3. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.
4. Beginning construction activities of this section indicates installer's acceptance of conditions.

3.02 INSTALLATION

- A. Field Fastening: Use fasteners as indicated on shop drawings.
- B. Metal Trusses:
 1. Install metal trusses in accordance with Truss Component Manufacturer's instructions and the Truss Fabricator's shop drawing submittal. Place components at spacings indicated on the Truss Fabricator's shop drawings. Install truss installation (erection) bracing. Truss installation (erection) bracing shall hold trusses straight and plumb and in safe condition until decking and permanent truss bracing has been fastened, forming a structurally sound framing system. All sub-contractors shall employ proper construction procedures to insure adequate distribution of temporary construction loads so that the carrying capacity of any single truss or group of trusses is not exceeded.
 2. Install required roof and system permanent bracing and bridging as indicated by the drawings and notes of the Architect or Engineer-of-Record. See the Truss Fabricator's shop drawings for any additional bracing requirements. All truss installation (erection) bracing and permanent bracing and bridging shall be installed before the application of any loads.
 3. The field removal, cutting or alteration of any truss chord, web or bracing members is not allowed without prior written approval of the Architect and the Truss Designer.

4. Damaged chords, webs and complete trusses shall be repaired or replaced as directed and approved in writing by the Architect and the Truss Designer prior to installation or application of the repair or replacement.
- C. Site Tolerances for Truss Bearings:
1. Variation from Level or Specified Plane: Maximum 1/8 inch in 10 feet.
 2. Variation from Specified Position: Maximum 1/4 inch.

3.03 FIELD QUALITY CONTROL

- A. Site Inspections: Inspection service to inspect field connections as required by Architect.

END OF SECTION 05421

SECTION 05.500 METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

A. Definition: Metal fabrications include items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems specified elsewhere. Among items included are:

1. Steel pan stair
2. Decorative Metal Railing System
3. Standard Steel Railings
4. Exterior Steel Railings
5. Steel lintels and shelf angles (galvanized)
6. Elevator pit and penthouse access ladder
7. Steel weld plates and angles
8. Metal cast downspout boots
9. Miscellaneous steel

B. Related Sections include the following:

1. Division 4 Section "Unit Masonry"
2. Division 5 Section "Exterior Steel Stud System"
3. Division 8 Section "Glazing"
4. Division 9 Section "Painting"

1.02 SUBMITTALS

A. Product Data: Submit manufacturers' product data of all manufactured items and products.

B. Shop Drawings

1. Submit shop drawings for fabrication and erection of miscellaneous metal fabrications. Include plans, elevations and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others.

a. Detailing Requirements: Detail steel components and items to be galvanized in accordance with applicable requirements of ASTM A384 and ASTM A385. Detail and fabricate work with suitable drain and vent holes to provide positive drainage and to prevent trapping of moisture and stagnant air.

1.03 QUALITY ASSURANCE

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrications where

possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

- B. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitation. Clearly mark units for reassembly and coordinated installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Metals

1. Metal surfaces, General: For Fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.
2. Steel Plates, Shapes and Bars: ASTM A36
3. Steel Tubing: Cold formed, ASTM A500; Class A or B.
4. Steel Pipe: ASTM A53; black finish, unless galvanizing is indicated; standard weight (Schedule 40), unless otherwise indicated.

B. Galvanizing

1. Steel and ferrous metal items on the exterior of buildings, items exposed to the weather and moisture, gratings, and items specifically indicated, shall be galvanized after fabrication by the hot-dip process in accordance with ASTM A123. Weight of the zinc coating shall conform with the requirements specified under "Weight of Coating" in ASTM A123. Provide high-quality galvanizing in conformance with ASTM A385.
2. Seal-weld Overlapping Surfaces: Remove all weld flux. Plug vents provided in sealwelded overlapping surfaces to prevent entry of pickling acids. Remove such plugs before galvanizing.
3. Safeguarding against steel embrittlement shall conform with the applicable requirements of ASTM A143.
4. Safeguarding against warpage and distortion of steel members shall conform with the applicable requirements of ASTM A384.
5. Shop galvanized metalwork necessitating field welding which in any manner removes original

galvanizing shall be restored by field galvanizing repair in accordance with ASTM A780.

6. Bolts and screws for attachment of galvanized items shall be galvanized in accordance with ASTM A153.

C. Paint

1. Metal Primer Paint

- a. Free of lead and chromate and comply with State and Federal volatile organic compound (VOC) requirements.
- b. Primer selected must be compatible with finish coats of paint. Coordinate selection of metal primer with finish paint requirements specified in Division 9.
- c. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, complying with Military Specifications MIL-P21035 (Ships).

2.02 FABRICATION, GENERAL

- A. Workmanship: Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in finished product. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise shown. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- C. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners, wherever possible. Use exposed fasteners of type shown or, if not shown, Phillips flat-head (countersunk) screws or bolts.
- E. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

- F. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.
- G. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

2.03 METAL FABRICATIONS

A. Rough Hardware

1. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures.
2. Manufacture or fabricate items of sizes, shapes and dimensions required.
3. Use galvanized steel hardware for galvanized steel members.

B. Steel pan stairs

1. Construct stairs to conform to sizes and arrangements indicated on drawings; join pieces together by welding unless otherwise indicated. Provide complete stair assemblies including metal framing, hangers, column, railing, struts, clips, brackets, bearing plates, & other components necessary for support of stairs and platforms & as required to anchor and contain stairs on the supporting structure.
2. The entire stairway shall surpass 100 lbs. per sq. ft. live load plus dead load.
3. Stair Framing: Fabricate stringers of structural steel tubes, or plates, or a combination thereof, as indicated. Provide closure for exposed ends of stringers where applicable. Construct platforms of structural steel tube header and miscellaneous framing members as required or indicated. Bolt or weld headers to stringers, newels and framing members to stringers and headers; fabricate and join whereby bolts, if used, do not appear on finish surfaces.
4. Metal Pan Riser and Sub-treads: Shape 12 gauge metal risers and sub-treads to conform to configuration as shown on drawings.
5. Attach metal riser and sub-treads to stringers by direct welds, locating welds on side of metal pans to be concealed by concrete fill.

- C. Decorative Metal Glass Railing System
 - 1. For all stairs where indicated on the drawings, provide railing system consisting of glass with aluminum handrails and accessories for a complete installation. See Specification 05.521 Decorative Stair and Guardrails.
- D. Standard Steel Railings
 - 1. Construct of steel members to design and sizes as indicated on Drawings using as a minimum components specified herein.
 - a. Handrail: Guardrail, Posts & 1 1/2" O.D. steel round pipe.
 - b. Bottom Rails: 3/4" square steel bars.
 - c. Pickets: 5/8" square steel bars.
 - d. Brackets: Julius Blum & Co. No. 382.
 - e. Return all rails to wall at ends.
 - 2. All connections to be welded, ground smooth, uniformly sandblasted, primed and painted per Division 9 Section "Painting".
 - 3. Adjust railings prior to securing in place to insure proper matching at butting joints and correct alignment throughout their length. Plumb posts in each direction. Anchor posts per details on Drawings. Where posts are anchored to floor, provide a minimum 3/8" steel plate welded to the bottom, 2" greater than the outside diameter of the post for securement.
- E. Exterior Steel Railings (42" high railing system)
 - 1. Basis of Design: Julius Blum & Co., Inc. Approved Comparable products by:
 - a. Architectural Metal Works
 - b. Livers Bronze Co.
 - c. Blumcraft/C.R. Lawrence
 - 2. #6930 Aluminum Handrail Mouldings - guard rail cap and handrails.
 - 3. 2-1/2"x2-1/2" square aluminum bar/posts with Aluminum Terminals (E), Center Pieces (T) and Corner Pieces (L) as required for a complete railing system.
 - 4. 1-1/2"x1-1/2" square aluminum bar-posts for use at stand alone handrails.
 - 5. #769 square hole aluminum base to be used at 1-1/2" posts.
 - 6. #1205 Aluminum tube socket with square hole.
 - 7. Straight Lamb's Tongue handrail fittings 6930S.
 - 8. Pickets to be 3/4" aluminum bars.

9. 1-1/2"x5/8"x1/8" aluminum channel top and bottom rails.
 10. #383 Aluminum brackets.
 11. Entire railing system to receive powder coat finish. Color to be selected from entire RAL color palette.
- F. Loose Steel Lintels
1. Provide loose structural steel lintels for openings and recesses in masonry walls and partitions as shown. Weld adjoining members together to form a single unit where indicated. Provide not less than 8" bearing at each side of openings, unless otherwise shown.
 - a. Loose steel lintels in exterior walls shall be galvanized.
 - b. Paint in accordance with Division 9 Section "Painting"
- G. Ladders - (elevator pit and access):
1. Fabricate ladders for the locations shown with dimensions, spacings, details and anchorages as indicated. Comply with the requirements of ANSI A14.3, except as otherwise indicated.
 2. Unless otherwise shown, provide 1/2" x 2-1/2" continuous structural steel flat bar side rails with eased edges, spaced 18" apart.
 3. Provide 3/4" diameter solid structural steel bar rungs, spaced 12 inches on center.
 4. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
 5. Support each ladder at top and bottom and at intermediate points spaced not more than 5'-0" on center. Use welded or bolted steel brackets, designed for adequate support and anchorage, and to hold the ladder clear of the wall surface with a minimum of 7" clearance from wall to centerline of rungs. Extend rails 42" above top rung, and return rails to wall or structure unless other secure handholds are provided.
 6. Provide non-slip surface on top of each rung with aluminum oxide granules set in epoxy resin adhesive.
- H. Loose Bearing and Leveling Plates: Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts.
- I. Shelf Angles (galvanized): Fabricate shelf angles of sizes indicated and for attachment to framing.

METAL FABRICATIONS

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Fabricate with horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c.

J. Miscellaneous Framing and Supports

1. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete work.
2. Fabricate miscellaneous units to sizes, shapes and profiles shown or, if not shown, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
3. Exterior Miscellaneous Steel Trim: Galvanize.

K. Cast Iron Trench Drain Grate

1. Trench drain grates shall be of cast iron as manufactured by Iron Age Designs: Model 6" wide Interlaken. Approved comparable products by:
 - a. Neenah Foundry
 - b. MIFAB, Inc.
2. Natural Finish - total thickness: 3/4"
3. Provide Drain Channels as manufactured by NDS; Duraslope
4. No openings greater than 1/2"
5. Free drain area = 16.5%

L. Metal Cast Downspout Boots

1. Downspout boots are to be cast iron with a minimum length of 40" as manufactured by Neenah Foundry or approved equal. Company Model R-4929-014C with a 4"x6" inlet size. Downspout boots connecting to underground drainage to have a 4" brass cleanout plug. Provide Fernco coupling-size as required.

2.04 FINISHES

A. Shop Painting

1. Shop paint miscellaneous metal work, except members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces, unless otherwise specified.
2. Remove scale, rust and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SSPC SP-

- 2 "Hand Tool Cleaning", or SSPC SP-3 "Power Tool Cleaning", or SSPC SP-7 "Brush-Off Blast Cleaning".
 3. Remove oil, grease and similar contaminants in accordance with SSPC SP-1 "Solvent Cleaning".
 4. Immediately after surface preparation, brush or spray on primer in accordance with manufacturer's instructions, and at a rate to provide uniform dry film thickness of not less than 2.0 mils for each coat. Use painting methods which will result in full coverage of joints, corners, edges and exposed surfaces.
 - a. Ensure shop primer compatibility with Division 9 Section "Painting". Primer per this Section shall be applied in addition to the shop primer as specified herein.
 - b. Apply one shop coat to fabricated metal items, except apply 2 coats of paint to surfaces inaccessible after assembly or erection.
 5. Finish paint per Division 9 Section "Painting".
- B. Galvanized Metalwork
1. Galvanized metal surfaces indicated to be painted shall be prepared for painting in accordance with ASTM D2092.
 2. Galvanized metal surfaces shall then be given a shop coat of galvanized primer in accordance with SSPC-PA 1. Materials and application shall conform with SSPC-Paint 20, Zinc-Rich Primers, Type I - Inorganic or Type II Organic.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.02 INSTALLATION

A. General

1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle

- bolts, through-bolts, lag bolts, wood screws and other connectors as required.
2. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for item which are to be built into concrete, masonry or similar construction.
 3. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch-up shop paint. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.
 4. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and the methods used in correcting welding work.
- B. Installing Bearing and Leveling Plates
1. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
 2. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 3. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.03 CLEANING

A. Touch-up Paint

1. Immediately after erection, clean ground field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanized surfaces which have become damaged from welding, handling, or installation shall be repaired

immediately after installation with galvanizing repair material in accordance with ASTM A780.
C. Finish paint all exposed steel per Division 9 Section "Painting".

END OF SECTION

SECTION 05510 METAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manufactured Pre-engineered metal stairs.
 - 2. Handrails and railings attached to metal stairs.
 - 3. Handrails attached to walls adjacent to metal stairs.
 - 4. Railing gates at the level of exit discharge.
- B. Related Sections:
 - 1. Section 03300, "Cast-in-Place Concrete" for concrete fill.
 - 2. Section 05500, "Pipe and Tube Railings" miscellaneous metals.

REFERENCES (Most current Edition or Version is applicable)

- C. ASTM A 36/A 36M: Specification for Carbon Structural Steel.
- D. ASTM A 53: Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- E. ASTM A 123: Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- F. ASTM A 153/A 153M: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- G. ASTM F 609-96: Non-slip surface test.
- H. ASTM A 500: Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- I. ASTM A 563: Specification for Carbon and Alloy Steel Nuts
- J. ASTM A 1011-A: Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.
- K. ASTM A 653/A 653M: Specification for Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated Galvanized by the Hot-Dip Process
- L. ASTM A 786/A 786M: Specification for Rolled Steel Floor Plates
- M. ASTM B 633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel

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- N. ASTM C 1107: Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
- O. ASTM E 488: Test Method for Strength of Anchors In Concrete and Masonry Elements
- P. ASTM E 894: Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings
- Q. ASTM E 935: Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings
- R. ASTM E 985: Specification for Permanent Metal Railing Systems and Rails for Buildings
- S. AWS D1.1: Structural Welding Code-Steel
- T. AWS D1.3: Structural Welding Code-Sheet Steel
- U. ASTM A307: Bolts

1.2 PERFORMANCE REQUIREMENTS

- A. Performance requirements: Stair manufacturer shall Engineer and fabricate stairs and railings to comply with requirements of the following, when installed:
- B. Structural Performance: Provide metal stairs and Railings capable of withstanding the following Structural loads without exceeding the allowable Design working stress of the materials involved, Including anchors and connectins.
 - 1. Treads and Platforms:
 - a. Unifrom load of 100 lbf/sq. ft.
 - b. Concentrated load of 250 lbf on an area of 4 sq in.
 - 2. Stair Framing:
 - a. Tread and platform loads
 - b. Railing system loads
 - 3. Limit deflection of stair members to L/240
 - 4. Top Rail:
 - a. Concentrated load of 250lbf applied at any point and in any direction
 - b. Uniform load of 50lbf/ft applied horizontally and concurrently with uniform load of 50 lbf/ft applied vertically downward
 - 5. Handrails:
 - a. Concentrated load of 250 lbf applied at any point and in any direction

SECTION 05510 METAL STAIRS

- b. Uniform load of 50lbf/ft applied horizontally and concurrently with uniform load of 50 lbf/ft applied vertically downward

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data substantiating compliance with drawings and specifications.
- B. Shop Drawings: Submit shop drawings for stair and railings. Include plans, elevations and details. Show connection and accessory items, indicate field welds. Show locations for anchor and bolt installation.
 - 1. Include design loads, structural calculations and material properties. Shop drawings shall be signed and sealed by a Professional Engineer licensed in the State of Mississippi.
- C. Samples: Submit samples for the following products
 - 1. Stair treads

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall have Produced the types of stair and railing systems required for not less than ten (10) years, with not less than five (5) similar projects that have been in successful use for not less than five (5) years
- B. Manufacturer Qualifications: A firm experienced in Manufacturing metal stairs similar to those indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units
- C. Installer Qualifications: Minimum five (5) years experience in the successful installation of steel stair and railing systems of the type indicated for this project
- D. Installer Qualifications: Metal stairs shall be installed by workmen experienced in the erection of metal stair systems
- E. Furnish test results that stair tread meets acceptable flame and smoke levels

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- F. Applicable Standards:
1. NAAMM Stair Standard: "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual", service For commercial class.
 2. AWS D1.1 "Structural Welding Code-Steel", AWS D1.3 "Structural Welding Code-Sheet Steel" and AWS "Welding Procedure and Performance Qualification"
 3. NOMMA "Guideline 1 - Joint Finishes" (Most Current Edition or Version is applicable)

1.5 WARRANTY

- A. Provide manufacturer's written warranty that is standard products are free from defects in material and workmanship for the life of the building and agreeing to repair or replace items, proven to be defective, or refund the purchase price of the item.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Acceptable Manufacturers: Drawings and specifications are based on products of American Stair Corporation, Inc. (800)- 872-7824 or approved equal. Provide the specified products included in this specification.

2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36
- B. Steel Tubing: Cold-formed steel stubbing complying with ASTM A 500.
- C. Rolled-Steel Floor Plate: ASTM A 786, rolled from plate complying with ASTM A 36 or ASTM A 283, Grade C or D.
- D. Steel Bars for Gratings: ASTM A 36.
- E. Wire Rod for Grating Crossbars: ASTM A 510.
- F. Hot-Rolled Steel Sheet: Commercial quality, complying With ASTM A 1011-A.
- G. Galvanized Steel Sheet: ASTM A 653, G90 coating, Either commercial quality or structural quality, Grade 33.

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- H. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal allow welded.
- I. Primer: Shall be manufacturers fast-curing, lead and Chromate-free, universal water reducible primer Complying with performance requirements for FS TT-P-664. Includes SSPC-SP3 (Power Tool Cleaning). Performance tests are based on 1.0-1.3 mils dry film thickness that equals or exceeds other alkyd primers Based on 2.0 mils.

2.3 FASTENERS

- A. Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 for other applications. Provide fastener type, grade, and class required and recommended and by stair manufacturer.

2.4 FABRICATION

- A. Exposed Work: True to line and level with accurate angles and surfaces with straight sharp edges. Use only smooth materials free from burrs, pitting and other marks.
 - 1. Fastener Connections: provide flush close-fit Joints at exposed connections.
 - 2. Welding Connections: Exposed welds to have finished appearance in accordance with NOMMA "Guideline 1 - Joint Finishes: for Finish#3.
- B. Provide complete stair and landing systems including Stringers, risers, treads, landing framing, landings, Connections and other components necessary for the Support and installation of stairs and landings.
- C. Comply with NAAMM "Metal Stairs Manual" requirements for the following Class:
 - 1. Industrial Class Stairs.
 - 2. Service Class Stairs.
 - 3. Commercial Class Stairs.
 - 4. Architectural Class Stairs.
- D. Stringers:
 - 1. Steel Plates.
 - 2. Tubing.
 - 3. Channels as required for compliance with performance requirements.

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- E Treads:
1. Metal Pan for Cast-in-Place Concrete: Sheet steel tread pan formed for concrete fill, factory-welded to stringers, with all welds on inside of pan to be concealed by field-poured concrete fill.
 - a. Product: Metal Pan Tread; American Stair Corporation, or approved equal.
 - b. Concrete Fill: Cast in place concrete with not less than 3000psi compressive strength. Refer to Section 03300 for concrete fill and reinforcing.
 2. Bar Grating: Welding steel bar grating with Integral steel checker plate nosing and welded Steel angle bracket, complying with NAAMM "Metal Bar Grating Manual". Standard size 3/16"x 1-1/4" bearing bars at 1-3/16 c. to c.
 - a. Product: Steel Bar Grating Tread; American Stair Corporation
- F. Nosing: Furnished by others.
- G. Risers:
1. Sheet Steel.
- H. Landing: Provide 4" toe plates at open edges of Landings. Provide landing type as follows:
1. Metal Pan Landing: Sheet steel decking Pan and factory-installed steel reinforcing Bars for field-poured concrete fill; steel Channel supports.
 - a. Product: Metal Pan landing; American Stair Corporation, or approved equal.
 - b. Concrete Fill: Cast in place concrete with not less than 3000psi compressive strength. Refer to Section 03300 for concrete fill and reinforcing.
 2. Bar Grating: Welding steel bar grating with Integral steel checker plate nosing and welded Steel angle bracket, complying with NAAMM "Metal Bar Grating Manual". Standard size 3/16"x 1-1/4" bearing bars at 1-3/16 c. to c.
 - a. Product: Steel Bar Grating Landing; American Stair Corporation.

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- I. Stair Unit Connections: Provide angle brackets, expansion anchors, weld plates and other connection devices as recommended by stair manufacturer for substrates indicated.
- J. Railings and Handrails: Maintain uniform curvature And cylindrical cross-section at each bend.
 - 1. Round Railing Multi Strand: 1-1/2" round tube Steel top and bottom members with 1-1/2" round tubular parallel strands:
 - a. Number of Strands: As required for compliance with specified performance requirements.
 - b. Height: Rail to be 34" or 43" high in accordance with governing code authority.
 - c. Product: FasTrack continuous top strand and FadeAway Posts; American Stair Corporation.
 - d. Product: FadeAway Posts; American Stair Corporation.
 - e. Product: FadeAway Posts and Zero Gap; American Stair Corporation.
 - f. Product: In-Line Posts; American Stair Corporation.
 - g. Product: 42" High Guardrail with Grabrail and In-Line Posts; American Stair Corporation.
 - 2. Wall-Mounted Handrails: Provide where indicated.
 - a. 1-1/2" round tubular rail with wall returns, with 1/4" stamped plate wall brackets for exposed fastener; flat extensions on top and bottom of length required by code.
 - 3. Stringer-Mounted Wall Railing: Provide where indicated.
 - a. 1-1/2" tubular rail with posts field assembled to stringers, with flat extensions at top and bottom of length required by code.
 - 4. Balcony Railing: Provide matching balcony railing Where indicated.

SHOP PAINTING

- K. Surface Preparation: SSPC SP-1 Solvent Cleaning, SSPC SP-3 Power Tool Cleaning as required. Shop Primer: Apply shop primer to stairs and railings

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SECTION 05510 METAL STAIRS

after fabrication.

1. Primer: Shall be manufacturers fast-curing, lead free, universal water reducible primer complying with performance requirements for FS TT-P-664.
 2. Dry Film Thickness: 1.0 - 1.3 mil. Dry film thickness that equals or exceeds other alkyd primers based on 2.0 mils.
- L. Galvanizing: Hot dip galvanize stairs and railings after fabrication in accordance with ASTM A-123.
1. Galvanizing Repair Paint: ASTM A-780.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Installer is responsible to examine conditions, under which metal stairs will be installed for compliance with manufacturer's installation requirements.

3.2 INSTALLATION

- A. Install stairs and railings in accordance with Manufacturer's instructions and approved drawings and to comply with specified performance requirements when installed.
- B. Fit exposed connections accurately together to form close fit joints.
- C. Provide anchorage devices and fasteners for securing stairs and railings to in-place construction.
- D. Weld connections which cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch-up shop paint coat.
- E. Clean field welds, bolted connections and abraded areas and prime with same material used for shop priming.
- F. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and rapair galvanized to comply with ASTM A 780.

3.3 TOUCH UP

- A. Touchup Painting: cleaning and touchup painting Of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting".

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SECTION 05510 METAL STAIRS

- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 05.515 ACCESS LADDERS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Aluminum inclined access ladders (penthouse access).

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications"

1.02 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product.

B. Shop Drawings

1. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.
2. Provide templates for anchors and bolts.
3. Provide reaction loads for each hanger and bracket.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.04 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurement before fabrication.

1.05 WARRANTY

A. Provide manufacturer's standard warranty of 5 years from date of Substantial Completion against all the conditions indicated below.

1. Defects in materials and workmanship.
2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.
3. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. O'Keefe's
- B. Precision Ladders
- C. Alaco Ladder Co.
- D. UPNOVR, Inc.

2.02 MATERIALS

- A. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.
- B. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

2.03 MANUFACTURED UNITS

- A. Provide fixed wall mounted roof access ladder heavy-duty Tubular Rail Aluminum ships ladder for handrail extension for mezzanine access with walk-thru safety handrail "Model U-501" as manufactured by UPNOVR, Inc.
 - 1. Height as indicated on Drawings (+/- 14'-0")
 - 2. Preferred angle is 75 degrees. Minimum angle is 60 degrees.

2.04 FABRICATION

- A. Treads: 6" wide by 1-3/4" deep by 24" wide aluminum channel shaped section with corrugated surface.
 - 1. Equally space treads as indicated on drawings and reviewed shop drawings.
 - 2. Connect treads to stringers with bolts to allow for future replacement.
- B. Stringers: 6 x 2-1/2" aluminum channel.
- C. Handrail: Fabricate from 1-1/4" diameter aluminum pipe.
 - 1. Form returns with 6" radius.
 - 2. Attach rail to stringer with pipe sections spaces at approximately 30" such that rail projects approximately 6" above stringer.
 - 3. Locate bottom of handrail 36" above floor.
 - 4. Extend rail above ladder such that top of rail is 42" above roof level.
- D. Accessories: Support Brackets. Support ship ladder with top wall brackets and bottom floor brackets fabricated from 2" x 1/4" minimum flat bar aluminum.

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2.05 FINISHES

- A. Clear Anodic Finish: AA-M10C22A41 Mechanical finish as fabricated. Architectural Class I, clear coating 0.018 mm or thicker.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.
- B. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.
- C. Notify Architect of unsatisfactory supporting work before proceeding. Start of work is acceptance of conditions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction.

3.03 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

ACCESS LADDERS

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SECTION 05.521 DECORATIVE STAIR AND GUARDRAILS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. All drawings, general and supplementary conditions including division one specifications apply to this section.

1.02 SUMMARY

A. Principle items specified in this section are:

1. Stainless/ wood combination handrails.
2. Stainless Steel mounting hardware.
3. Tempered glass structural infill panels.

1.03 WORK INCLUDED

A. Provide all materials, labor and equipment necessary to fabricate and completely install handrails, guardrails, and tempered glass structural panels as shown on drawings or specified herein.

1.04 DEFINITIONS

A. Terms and definitions from ASTM E985 and ISO/TC 59 for railing related items apply to this section.

1.05 SYSTEM PERFORMANCE REQUIREMENTS

- A. Railings shall meet or exceed the requirements of all applicable building codes.
- B. Railings shall have high strength stainless steel with adequate safety margin.
- C. All internal members shall be stainless steel or nylon to eliminate the possibility of rust.
- D. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- E. Handrails
 1. Uniform load of 50lbf/ft. applied in any direction.
 2. Concentrated load of 500 lbf applied in any direction.
 3. Uniform and concentrated loads need not be assumed to act concurrently.
- F. Top Rails of Guards
 1. Uniform load of 50lbf/ft. applied in any direction.

2. Concentrated load of 200 lbf applied in any direction.
 3. Uniform and concentrated loads need not be assumed to act concurrently.
- G. Infill of Guards
1. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 2. Structural glass panels shall be fully tempered 1/2" thick.

1.06 SUBMITTALS

- A. Shop drawings, showing fabrication and installation of handrails and railings including plans, elevations, sections, details of components and attachments to other units of work.
- B. Product data for stainless steel/ nylon products to be supplied in the form of a Material Safety Data Sheet from manufacturer.
- C. Structural computations or test data/evaluations, material properties and other information needed to ensure satisfactory structural compliance to applicable building codes to be supplied by the manufacturer based on final fabrication drawings.
- D. 6" long handrail samples complete with supports and rosette covers to display stainless steel grade/ wood and finish.

1.07 QUALITY ASSURANCE

- A. All materials shall be supplied and installed by a single manufacturer.
- B. Qualification data for factory authorized installers specified in "Quality Assurance" is to demonstrate their capabilities and experience. Include list of completed projects with project names and architect names.
- C. Execution tolerance plus/ minus 5/64" (2mm).

1.08 STORAGE

- A. Storage handrails and railing systems in clean, dry location, away from uncured concrete and masonry, protected against damage of any kind.
- B. Materials must be kept in original packing until installation.
- C. Materials to be stored at not lower than -40°C (-40°F) or higher than 100°C (212°F).

1.09 PROJECT CONDITIONS

- A. All measurements for handrails and railings should be taken from construction site elements to which railings are to fasten. This information to be recorded on final shop drawings.
- B. Coordinate fabrication schedule with construction progress to avoid delay of work.

PART 2 PRODUCT

2.01 MANUFACTURERS

- A. Handrail Design Inc. (HDI Railing Systems)
- B. Blumcraft of Pittsburgh
- C. Julius Blum & Co., Inc.

2.02 MATERIALS

- A. Provide railing system "Optik Railing System" as manufactured by HDI Railing System and as detailed on Drawings.
- B. Rails and other tubular components
 - 1. Stainless steel handrail: grade UNS 1.4305, type 304; surface to be #6 finish (240 grain/grit); tubes 1-9/16" outside diameter by 5/64" wall thickness.
 - 2. Fastening and attachment hardware for structural glass to be as specified in fastening section and base to be Aluminum alloy 6063-T52.
 - 3. Handrail fastening bolts to be stainless steel or other high strength material as determined by engineering requirements.
 - 4. Neoprene gasket material to be used at all through bolt connections to ensure separation between metal and glass.
- C. Posts and other components
 - 1. Post Steel to be type A36 - 2" by 1/4". Hardware attachment surface to be on inside of post formed from the post bar. Attaching hardware to be fastened by vertically sliding clamps.
 - 2. Surface mount fastening plates and clamps to be made from steel type A36.
 - 3. Clamps, end block at top of post and handrail attachment all to be Stainless steel grade UNS 1.4305, type 304. Surface to be 240 grain/grit finish to match handrail finish.

- D. Shoe Base
 - 1. Profile: Part # B7S; 2-3/4 inches (69.8 mm) wide by 4-1/8 inches (104.7 mm) high rectangular cross-section.
 - 2. Material: Aluminum 6063 - T52
 - 3. Finish Architect to select from manufacturers full line of finishes
 - 4. Base Cladding: Sheet metal cladding added to exposed shoe base sections. Adhere with double-sided tape and/or silicone adhesive. Provide end caps where ends of shoe base sections are exposed.
- E. Fasteners
 - 1. Steel angle profiles conforming to ASTM A 36, with anchoring devices, sizes indicated in shop drawing of section 05.522, drilled and tapped for fastener types, sizes and spacing indicated.
- F. Glazing infill: 1/2" thick clear safety glass as specified in Division 8 Section "Glazing". Tempered glass: Provide fully tempered safety glass with polished edges and dubbed (blunt) corners complying with ASTM C1048.

2.03 FABRICATION

- A. Fabricate railing system for compliance with structural requirements of applicable code.
- B. Pre-assemble railings prior to shipping to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and for coordination with shop drawings.
- C. Stainless steel tubing cuts shall be square, without burrs and where exposed, rounded to produce smooth rigid and hairline joints.

PART 3 EXECUTION

3.01 PREPARATION

- A. Provide information on fastening point locations for posts where necessary to relevant parties.

3.02 INSTALLATION

- A. Installation shall be by the fabricating manufacturer or a qualified, authorized representative of the manufacturer.

- B. Installation must be in accordance with installation/shop drawings provided by the manufacturer.
- C. Install components plumb and in-line, accurately fitted, free from distortion or defects and securely anchored to structure.
- D. Provide anchors, plates, angles, etc., necessary for connecting railings to structure.
- E. Any and all field welding shall be by a certified welder.

3.03 ERECTION TOLERANCES

- A. Maximum variation from plumb shall be 1/4".
- B. Maximum offset from true alignment for every 50-foot of railing shall be 1/4", non-accumulative.

3.04 CLEANING

- A. Railings shall be cleaned, including infill panels, prior to substantial completion.
- B. Wipe with moistened cloth only. Do not use cleaning agents with abrasive or acid/alkaline content.

3.05 PROTECTION

- A. Provide protection covering on all hand and guardrails if construction is not yet finished in the area.
- B. All deficiencies in work and/or items not meeting specified requirements shall be corrected in order to meet specification requirements at no additional cost to owner.

END OF SECTION

SECTION 05.723 CAST-IN-PLACE STAIR NOSINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

1.02 WORK INCLUDED

A. Furnish and install two-component stair nosing systems at Architectural Precast Concrete steps.

1.03 RELATED WORK

A. Related work which is specified elsewhere
1. Concrete work: Section 03.450 Architectural Precast Concrete

1.04 REFERENCES

A. Publications listed herein are part of this specification to the extent referenced. The criteria established in the specifications shall take precedence over the standards referenced herein.
1. American Society for Testing and Materials (ASTM)
a. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes

1.05 SYSTEM DESCRIPTION

A. Stair nosing assemblies shall be cast-in-place.
B. Stair nosing treads shall be ribbed.
C. Stair nosing tread surfaces shall be slip resistant.
D. Stair nosing treads shall be removable and replaceable.
E. Stair nosing treads shall meet OSHA Barrier-Free Code requirements for stair design in public buildings.
F. Abrasives with cementitious-based resins shall not be acceptable.

1.06 QUALITY ASSURANCE

A. Manufacturer: Obtain stair nosing assemblies through one source from an approved manufacturer.

CAST-IN-PLACE STAIR NOSINGS

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1. Manufacturer shall be ISO 9001:2000 Certified or shall be an approved manufacturer for an ISO Certified Supplier.
 - a. ISO 9001:2000 Certified Manufacturer shall have documented management and control of the processes that influence the quality of its products.
 - b. Approved Manufacturer shall be approved by the Approved Supplier and shall have documented specifications that control their processes and influence the quality of its customer service.
 2. Manufacturer shall have a minimum of ten (10) years of experience in the fabrication of stair nosing systems.
- B. Installer: Firm with not less than three (3) years of successful experience in the installation systems similar to those required by this project and acceptable to the manufacturer of the system.

1.07 SUBMITTALS

- A. Submit manufacturer's specifications and technical data, including Material Safety Data Sheets, installation instructions, as required, and catalog cuts and templates where required to explain construction and to provide for incorporation into the project.
- B. Submit certificates and/or copies of independent test reports or research reports compliance with specified performance requirements.
- C. Submit shop drawings showing complete fabrication details for all stair nosings, including anchorage to surrounding construction.
- D. Submit three (3) 6" samples of the specified system.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Deliver stair nosing assemblies to jobsite in new, clean, unopened crates of sufficient size and strength to protect materials during transit.
- B. Store components in original containers in a clean, dry location.

1.09 WARRANTY

- A. Submit manufacturer's warranty that materials furnished will perform as specified for a period of

not less than one (1) year when installed in accordance with manufacturer's recommendations.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Balco, Inc.
- B. Nystrom Building Products
- C. Wooster Products, Inc.

2.02 MATERIALS

- A. Stair nosing system: Balco DST-330 (Basis of Design)
 - 1. Aluminum: ASTM B 221, alloy 6063-T5 for extrusions
- B. Abrasive
 - 1. Standard Abrasive: Two (2) part Epoxy combined with aluminum oxide grit.
- C. Fasteners required for complete installation to manufacturer's instructions.

2.03 FABRICATION

- A. Fabricate stair nosing assemblies as detailed. Provide anchors and accessories necessary for complete installation.
 - 1. Fabricate solid surface abrasive tread 3/8 inch thick by width of tread as shown on drawings. Center layout on the center of stair width.
 - 2. Provide abrasive treads of specified color.
 - 3. Provide specified anchors and, where required, tread plate securing screws.
 - 4. Surfaces to be embedded in concrete shall be coated with a clear acrylic lacquer.
- B. Package components with anchors.

2.04 FINISHES

- A. Aluminum subchannels and tread plates shall be:
 - 1. Mill finish.
 - 2. Heat-treated for strength.
 - 3. Clear acrylic lacquer coated for components to be embedded in concrete.
- B. Abrasive treads color to be selected by Architect from manufacturer's full line of colors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Installer shall examine conditions under which work is to be performed and shall notify the contractor in writing of unsatisfactory conditions. Installer shall not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 INSTALLATION

A. Install stair nosings in accordance with the governing regulations, the industry standards applicable to the work, and the manufacturer's written installation instructions.

1. Sub-channels of two component stair nosings shall be installed with the architectural pre-cast concrete pour.

2. Abrasive tread plates of two component stair nosings shall be installed in the final stages of construction

B. Work shall be aligned plumb, level, and, where required, flush with adjacent surfaces and rigidly anchored to the substrate.

3.03 CLEANING

A. Clean exposed surfaces as recommended by the manufacturer.

3.04 PROTECTION

A. Advise the contractor of procedures required to protect the finished work from damage by work of other Sections during the remainder of the construction period.

B. Finished units shall be without damage. Units damaged during shipping or construction shall be repaired by the contractor at the expense of the party damaging the material, in accordance with the contract requirements.

3.05 GENERAL RESPONSIBILITY

A. Any variation from this specification resulting in additional cost to any other contractor or subcontractor on this project shall be the sole

financial responsibility of the contractor for the work of this section.

END OF SECTION

CAST-IN-PLACE STAIR NOSINGS
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SECTION 05.753 COLUMN COVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured architectural column covers.

1.02 RELATED REQUIREMENTS

A. Section 03.300 - Cast-in-Place Concrete

B. Section 07.920 - Joint Sealants

1.03 REFERENCE STANDARDS

A. AAMA 609 & 610-02 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum.

B. AAMA 2605 - High Performance Organic Coatings on Architectural Extrusions and Panels.

C. ASTM A 36 - Carbon Structural Steel; 2005.

D. ASTM A 123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.

E. ASTM A 153- Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

F. ASTM A 276 - Stainless Steel Bars and Shapes; 2006.

G. ASTM A 240 - Stainless Steel Sheet and Plate; 2007.

H. ASTM A 480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2006b.

I. ASTM A 666 - Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2003.

J. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

K. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.

L. ASTM B 221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2006.

M. ASTM C 297 - Standard Test Method for Flatwise Tensile Strength of Sandwich Construction.

N. ASTM D 1781 - Standard Test Method for Climbing Drum Peel for Adhesives.

O. ASTM D 4145 - Standard Test Method for Coating Flexibility of Prepainted Sheet; 1983 (Reapproved 2002).

P. ASTM D 4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2007.

Q. ASTM E 84 - Standard Test Methods for Surface Burning Characteristics of Building Materials; 2008.

R. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings.

1.04 SUBMITTALS

- A. Column cover manufacturer qualifications.
- B. Product Data: Column cover manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
 - 1. Finish manufacturer's data sheet showing physical and performance characteristics.
 - 2. Storage and handling requirements and recommendations.
 - 3. Fabrication instructions and recommendations.
 - 4. Specimen warranty for finish, as specified herein.
- C. Shop Drawings: Show layout and elevations, dimensions and thickness of column cover material, finishes and textures, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcements, and accessories.
 - 1. Indicate column cover numbering system if applicable.
 - 2. Differentiate between shop and field fabrication.
 - 3. Indicate substrates and adjacent work with which the column covers must be coordinated.
- D. Samples: Submit two (2) selection and verification samples of column cover, 12 inch by 12 inch in size illustrating finish color, sheen, and texture.
- E. Installer's Qualifications: Include a minimum of three (3) projects with similar types of interior column covers, with facility contact information.
- F. Certificate: Certify that the work results of this section meet or exceed specified requirements.
- G. Manufacturer's installation instructions.
- H. Manufacturer's Field Reports: Provide within 48 hours of field review. State what was observed and what changes, if any, were requested or required.
- I. Maintenance Data: Care of finishes and warranty requirements.
- J. Executed Warranty: Submit warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.

- B. Column cover manufacturer qualifications: Company specializing in manufacturing products specified in this section.
 - 1. Approved by ACM sheet manufacturer.
- C. Installer Qualifications: Experienced in performing work of the type specified in this section.
 - 1. With minimum 3 years of documented experience in installation of metal column cover similar to the work of this section.
 - 2. Approved by column cover manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
 - 1. Protect finishes by applying heavy duty removable plastic film during production.
 - 2. Package for protection against transportation damage.
 - 3. Provide markings to identify components consistently with drawings.
 - 4. Exercise care in unloading, storing and installing column covers to prevent bending, warping, twisting and surface damage.
- B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

1.07 WARRANTY

- A. See Division 1 - Closeout Submittals, for additional warranty requirements.
- B. See manufacturer for additional information on extended warranty periods for high performance coatings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. C.R. Laurence Co., Inc., P.O. Box 58923, Los Angeles, CA 90058-0923; Tel: (800) 421-6144 or (323) 588-1281 Ext. 7770; Fax: (866) 921-0532 or (323) 584-5226; Email: archmetals@crlaurence.com, or approved equal.

2.02 MANUFACTURED COLUMN COVERS

- A. Column cover: Premier Dry System preformed and prefinished architectural column cover; round, two

panel opposing, aluminum composite material, size as indicated on drawings.

1. Length of column covers as indicated on Drawings.
2. Size of round column covers as indicated on Drawings.

2.03 MATERIALS

- A. Precoated Aluminum Sheet: ASTM B 209, 5052-H32 smooth surface texture; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.
 1. Thickness: 1/8 inch thick.
 2. Finish: Satin anodized.
- B. Metal Framing Members: Angles, channels, z-clips, hat-shaped and furring channels, provided under Section 05.421 Pre-Engineered Cold-Formed Steel Truss System. 11 gage galv. Steel angles, continuous length full height of column. Select size of angle best suited to size of structural column, and diameter of column cover.
- C. Anchors, Clips and Accessories: As recommended by manufacturer.
- D. Fasteners: Self-Drilling stainless steel screws as recommended by manufacturer.

2.04 ACCESSORIES

- A. Field Touch-up Paint: As recommended by column cover manufacturer.

2.05 FABRICATION

- A. Form column cover sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest practicable lengths.
- C. Stiffeners are fabricated from same material as column cover.
- D. Return seams on column covers are bent using press brake machine.
- E. Curve forming of column covers is by plate roller.
- F. Form returns at vertical joints to provide uniform reveal as indicated on shop drawings.
- G. Fabricate column covers to allow for thermal movement without sealant failure, buckling, or other deformation of column cover appearance.
- H. Premier dry system: Form seam at vertical joints with keyhole slot and stainless steel shoulder screw attachment to provide a tight (no reveal) dry joint as indicated on shop drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and interfaces with other work are acceptable for column covers installation.
- B. Verify substrate on-site to determine that conditions are acceptable for column cover installation in accordance with manufacturers written instructions.
- C. Notify Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have been corrected.
- D. Verify that metal framing members specified under related Sections including; angles, channels, attachment clips, or other attachments to structure are installed in accordance with Drawings, shop drawings, and in accordance with column cover manufacturer's installation instructions.

3.02 PREPARATION

- A. Protect adjacent work areas and finish surfaces from damage during installation.

3.03 INSTALLATION

- A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.
- B. Comply with instructions and recommendations of column cover manufacturer, as well as with approved shop drawings.
- C. Fasten column covers to metal framing members; aligned, level, and plumb.
- D. Use concealed fasteners unless otherwise approved by manufacturer.
- E. Do not cut, trim, weld, braze, rout, bend, or otherwise form column covers during erection in a manner that would result in damage to finish, decrease structural integrity of column cover, or result in visual imperfections. Return damaged components to manufacturer's fabrication site.
- F. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.

- G. Where joints are designed for field applied sealant, seal joints completely with specified sealant.
- H. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- I. Replace damaged products.

3.04 TOLERANCES

- A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.
- B. Maximum Variation from Plane or Location Indicated on Drawings: 1/8 inch.

3.05 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.
- C. Clean aluminum surfaces in accordance with recommendations found in AAMA 609 and 610. Do not use aggressive alkaline, TSP, acid cleaners, or abrasive cleaners on aluminum surfaces.
- D. Clean stainless steel surfaces with non-abrasive detergents, soap, ammonia and warm water; rinse with clean water.

END OF SECTION

SECTION 06.100 ROUGH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

- A. Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated. Types of work in this Section include rough carpentry for:
 - 1. Framing lumber and plywood (including treated and fire retardant)
 - 2. Wood nailers and blocking
 - 3. Other rough carpentry indicated
 - 4. Exterior gypsum sheathing is as specified in Division 9 Section "Gypsum Board Assemblies".
- B. Related Sections include the following:
 - 1. Division 6 Section "Finish Carpentry"
 - 2. Division 6 Section "Interior Architectural Woodwork"
 - 3. Division 9 Section "Gypsum Board Assemblies"

1.02 REFERENCES

- A. Lumber Standards: Comply with PS 20
- B. Plywood Performance Standards: Must comply with PS2-92 and APA Performance Rating Standards.
- C. Factory mark each piece of lumber and plywood with type, grade, mill and grading agency

1.03 DELIVERY STORAGE, AND HANDLING

- A. Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and provide air circulation within stacks.

1.04 PROJECT CONDITIONS

- A. Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, and similar supports to allow proper attachment of other work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Framing Lumber
 - 1. Nominal sizes are indicated, except as shown by detail dimension.

2. Provide actual sizes as required by PS 20, graded in accordance with established grading rules for moisture content specified for each use.
3. Provide dressed lumber, S4S, unless otherwise indicated.
4. Provide kiln-dried lumber with 15% maximum moisture content at time of dressing.
5. Southern Yellow Pine or Douglas Fir of following species and grades:
 - a. Structural Light Framing: Stress Group 1500 F, #2 Dense KD Grade.
 - b. Non-structural light framing: Stress Group 1500 F
6. Miscellaneous Lumber:
 - a. Provide wood for support or attachment of other work including bucks, nailers, blocking, furring, stripping and similar members. Provide lumber of sizes shown or specified worked into shapes shown.
 - b. Grade: Standard or No. 2 Southern Pine.

B. Plywood

1. General
 - a. Minimum Construction Standards of Plywood are as follows (thickness as indicated on Drawings):
 - (1) 1/2" shall be 4 ply
 - (2) 5/8" shall be 5 ply
 - (3) 3/4" shall be 6 ply
 - b. Warped plywood panels are not acceptable.
 - c. Provide pressure treated plywood at areas indicated on the drawings.
2. General Plywood Sheathing
 - a. Size: as indicated on Drawings.
 - b. Grade: APA Rated Sheathing
 - c. Span Rating: 32/16
 - d. Exposure Durability: Exposure 1
3. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire retardant treated plywood panels with grade designation, APA C-C Plugged INT with exterior glue, in 3/4" thickness, 6 ply construction.

2.02 ACCESSORIES

- A. Fasteners and Anchorages: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable

Federal Specifications for nail, staples, screws, bolts, nuts, washers and anchoring devices.

- B. Where rough carpentry work is exposed to weather, provide fasteners and anchorages with a hot-dip zinc coating (ASTM A153).
- C. Adhesive
 - 1. Multipurpose Construction Adhesive: maximum VOCs: 70 grams/liter

2.03 WOOD TREATMENT

- A. Comply with applicable standards for the American Wood Preservers Association (AWPA). Each piece shall bear the quality mark of an independent agency or inspection service certified by these organizations to inspect treated materials.
 - 1. Use wood treated with preservative Ammoniacal Copper Quaternary (ACQ).
 - 2. Chromated copper arsenate (CCA) or other arsenic containing preservatives will not be accepted.
- B. Preservative Treated (PT) Wood: All wood in contact with ground and concrete, or indicated as Treated or preservative treated (such as when in contact with masonry, steel, and other conditions) shall be pressure treated in accordance with AWPB Standards. Retention levels and use categories are as follows:
 - 1. Above Ground: .25 (UC1-3)
 - 2. Ground Contact: .40 (UC4A)
 - 3. Ground Contact (Structural): .60 (UC4B)
- C. Borates (SBX) waterborne preservative may be used above ground and continuously protected from liquid water applications such as sill plates or other enclosed structural framing at retentions of 0.25 lbs/cubic foot.
- D. Where possible, all special cuts and holes should be fabricated before treatment. If cut after treatment, coat surfaces with liberal brushed solution of copper naphthenate containing a minimum of 2 percent metallic copper in solution in accordance with AWPA Standard M4.

2.04 FIRE TREATMENT

- A. Fire-retardant treated wood shall be pressure treated with fire retardants conforming to AWPA P17. Fire retardant treatment of wood products shall conform to the requirements of AWPA U1, Commodity Specification H and AWPA T1, Section H. Treatment and performance inspection shall be by an independent and

qualified testing agency that establishes performance ratings. Each piece or bundle of treated material shall bear identification of the testing agency to indicate performance in accordance with such rating. Fire-retardant-treated wood products shall be free of halogens, sulfates, ammonium phosphate, and formaldehyde.

PART 3 EXECUTION

3.01 INSTALLATION

A. General Requirements

1. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.
2. Framing lumber and other rough carpentry shall be fitted closely, set accurately to the required lines and levels and shall be secured in place in a rigid and substantial manner.
3. All framing and support members, not indicated or specified, shall be provided as necessary for the proper completion of the work.
4. Spiking, nailing and bolting shall be done in an approved manner; spikes, nails and bolts shall be of the proper size, and care shall be used so as not to split the members. Members shall be drilled accurately for bolting; and for nailing where necessary to avoid splitting. Suitable washers shall be provided under bolt heads, and nuts and bolts shall be drawn up tight.
5. Provide framing to support all edges of covering material.

B. Wood Nailers, and Blocking

1. Provide wherever shown and where required for attachment of other work. Form to shapes as shown or required and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
2. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry during installation of masonry work.

C. Installation of Plywood

1. General: Comply with applicable recommendations contained in Form No. E 304 "APA Design/Construction Guide - Residential &

Commercial" for types of plywood products and applications indicated.

2. Apply sheathing with long dimension (face grain) perpendicular to framing. Apply with side edges 1/4 inch apart and end edges 1/8 inch apart. All end edges of sheathing shall bear on a support. Stagger end joints of roof sheathing.
3. For wood framing, nail to supports with 6d common nails spaced 6 inches on center along edges and 12 inches on center at intermediate supports.
4. Use 11 gauge galvanized roofing nails 1-3/4" inches long with 7/16 inch heads for wood framing. Fasteners shall be installed at 6" o.c. on panel edges, at 12" o.c. along intermediate supports, and 3/8" minimum from panel edge.

3.02 CLEANING

- A. Remove and recycle all excess material.
- B. Separate the following categories for salvage or reuse on site:
 1. Sheet materials larger than 2 sq. ft.
 2. Framing members larger than 16"
 3. Multiple offcuts of any size larger than 12"
- C. Set aside damaged wood for acceptable alternative uses; for example, use as bracing, blocking, cripples, or ties.
- D. Separate the following categories for disposal and place in designated areas for hazardous materials:
 1. Treated, stained, painted, or contaminated wood.

END OF SECTION

SECTION 06.200 INTERIOR FINISH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

- A. Definition: Finish carpentry includes carpentry which is exposed to view is non-structural, and which is not specified as part of other Sections. Types of finish carpentry work in this section include:
1. Finish wood - panel and solid product
 2. Standing and Running Trim
 3. Other finish wood work indicated.
- B. Related Sections include the following:
1. Division 6 Section "Rough Carpentry"
 2. Division 6 Section "Interior Architectural Woodwork"
 3. Division 6 Section "Solid Surface"
 4. Division 8 Section "Flush Wood Doors"

1.02 SUBMITTALS

- A. Shop Drawings - Submit shop drawings showing location of each item, dimensioned plans and elevations, large scale details, surface grain directions, profiles, assembly methods, joint details, attachment devices and other components
- B. Samples
1. Provide minimum 12" x 12" for panel products, 12" long for solid wood products for transparent finish, for each species and cut, finished on one side and one edge.
 - a. Provide step sample for solid and veneer woods showing each stage of finishing process.
- C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.03 QUALITY ASSURANCE

- A. Forest Certification: Provide wood products obtained from forests certified by an FSC-accredited certification body.
- B. Quality standards - except as otherwise shown or specified, comply with AWI's Architectural Woodwork Quality Standards for grades of interior

architectural woodwork, construction, finishes and other requirements.

C. Provide AWI Quality Certification Program Certificates indicating that the woodwork, including installation, complies with requirements of grades specified.

1. Provide 1 inspection from AWI at the shop to ensure that the woodwork complies with the requirements of the grades specified. A written report shall be submitted to the Architect prior to the woodwork arriving on-site to be installed.

1.04 DELIVERY, STORAGE AND HANDLING

A. Protect finish carpentry materials during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

B. Do not deliver finish carpentry materials until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If due to unforeseen circumstances, finish carpentry materials must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.05 PROJECT CONDITIONS

A. Conditioning: Installer shall advise contractor of temperature and humidity requirements for woodwork installation areas. Do not install woodwork until required temperature and relative humidity have been stabilized and will be maintained in installation areas.

B. Maintain temperature and humidity in installation area as required to maintain moisture content of installed woodwork within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period. The fabricator of woodwork shall determine optimum moisture content and required temperature and humidity condition.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Wood Moisture Content
 - 1. Provide kiln-dried (KD) lumber with an average content range of 6% to 11%. 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:
 - 2. Interior Wood Finish: 8% - 13%.
- B. Interior Hardwood - Solid for Transparent Finish:
 - 1. Cherry, plain sliced
- C. Interior Hardwood - Plywood for Transparent Finish:
 - 1. Grade: Custom with Grade AA faces.
 - 2. Species: cherry, select red
 - 3. Cut: plain sliced (flat sliced)
 - 4. Match between adjacent veneer leaves: Book match
 - 5. End matching: Architectural End Match
 - 6. Matching within Individual Panel Faces: Center Balance Match
 - 7. Matching of panels within an Area:
 - a. Sequence Matched Uniform Size Set
 - (1) All veneer in the same Area shall be from the same flitch.
 - 8. Trim and Edges:
 - a. Trim and edges shall be solid wood construction of same species and cut as panel faces and compatible with grain and color of panel faces.
- D. Interior Wood for Opaque Finish (Softwood):
 - 1. Solid Wood: Yellow-Poplar or any softwood rated "good" or "excellent" for paint finishing in AWI "Guide to Wood Species", and meeting requirements for specified woodwork grade.
 - 2. Plywood: APA Group 2, Exposure 1 or 2, Grade A on exposed faces, Grade D or better on concealed faces (such as backs of shelving units against wall).

2.02 ACCESSORIES

A. Rough Hardware

- 1. Provide all necessary nails, screws and other hardware to properly secure members in place. Use finish or casing nails and trim head screws as appropriate where exposed.

2.03 FABRICATION

A. General

1. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber at time of fabrication and for relative humidity conditions in the installation areas.
2. Fabricate woodwork to dimensions, profiles and details indicated with openings and mortises precut, where possible, to receive hardware and other items and work.
3. Complete fabrication, assembly, finishing, and other work before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming and fitting.
4. Measurements: Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain field measurements and verify dimensions and shop drawing details as required for accurate fit.

B. Paneling Grade: Fabricate to AWI Custom Standards.

C. Standing and Running Trim

1. Fabricate to AWI Custom Standards.
2. Shop prepare and identify components for grain matching during site erection.
3. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
4. Sand work smooth and set exposed nails.
5. Apply wood filler in exposed nail indentations.
 - a. Wood filler to match surrounding surfaces and of type recommended for applied finish.

2.04 FINISHES

A. Finish architectural woodwork at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

B. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling.

C. Transparent Finish

1. Grade: Custom

2. AWI Finish System: Conversion varnish, solvent based.
 3. Staining: Match approved samples for color. Sample to be provided by Architect.
 4. Fillers: Apply a wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
 5. Sheen
 - a. Gloss units measured on 60-degree gloss meter per ASTM D 523.
 - b. Semigloss, 46-60 gloss units.
- D. Opaque Finish
1. Finish per Division 9 Section "Painting".

PART 3 EXECUTION

3.01 EXAMINATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.
- B. Prior to installation of Finish Carpentry, examine shop fabricated work for completion, and complete work as required, including removal of packing.

3.02 INSTALLATION

- A. Grade: Install paneling and solid wood components to comply with requirements of AWI Custom Grade.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- C. For flush paneling, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/16 inch.
- D. Scribe and cut paneling to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips (Z-clips) ONLY. Do not use face fastening.
- F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Scarf running joints and stagger in adjacent and related members. Fill gaps, if any, between top of base and wall with plastic wood

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filler, sand smooth, and matching final finish where transparent finish is indicated.

3.03 ADJUSTING

A. Repair damaged and defective work wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace work. Adjust joinery for uniform appearance.

3.04 CLEANING

- A. Clean work on exposed and semi-exposed surfaces.
- B. Remove and recycle all excess material.
- C. Separate the following categories for salvage or reuse on site:
 - 1. Sheet materials larger than 2 sq. ft.
 - 2. Multiple offcuts of any size larger than 12"
- D. Separate the following categories for disposal and place in designated areas for hazardous materials:
 - 1. Treated, stained, painted, or contaminated wood.

3.05 PROTECTION

A. Installer of Finish Carpentry shall advise Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

END OF SECTION

SECTION 06.402 INTERIOR ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Plastic-laminate cabinets.
 - 2. Architectural cabinets.
 - 3. Architectural shelving.
 - 4. Plastic-laminate countertops.
 - 5. Accessories
- B. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips unless concealed within other construction before woodwork installation.
- C. Related Section include the following:
 - 1. Division 6 Section "Rough Carpentry".
 - 2. Division 6 Section "Interior Finish Carpentry".
 - 3. Division 6 Section "Quartz Solid Surface".

1.02 SUBMITTALS

- A. Product Data: For cabinet hardware and accessories.
- B. Shop Drawings: The Contractor shall submit detail drawings showing fabricated items and special mill and woodwork items. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation. Include dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- C. Samples
 - 1. Plastic-laminates and solid surfacing for each type, color, pattern, and surface finish.
- D. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.03 QUALITY ASSURANCE

- A. Quality standards - except as otherwise shown or specified, comply with AWI's Architectural Woodwork Quality Standards for grades of interior architectural woodwork, construction, finishes and other requirements.
- B. Provide AWI Quality Certification Program Certificates indicating that the woodwork, including

installation, complies with requirements of grades specified.

1. Provide 1 inspection from AWI at the shop to ensure that the woodwork complies with the requirements of the grades specified. A written report shall be submitted to the Architect prior to the woodwork arriving on-site to be installed.

1.04 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 PRODUCTS

2.01 MATERIALS

A. Wood Products

1. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing **no urea formaldehyde**.
2. Softwood Plywood: DOC PS 1, Medium Density Overlay.
3. Provide hardwood products per Division 6 Section "Interior Finish Carpentry".

- B. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. [Formica Corporation](#)
- b. [Wilsonart International](#)
- c. [Abet Laminati](#)

2.02 ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural woodwork.

B. Hinges:

1. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, self-closing.

- C. Wire Pulls: [6-11/16" Flat top pull \(DP129-SSS\)](#) by Doug Mockett & Company, Back mounted.

- D. Drawer Slides: Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
- E. Door Locks: BHMA A156.11, E07121.
- F. Drawer Locks: BHMA A156.11, E07041.
- G. Shelf Supports: Where shelving is indicated as "adjustable shelf standards", provide Hafele standard, 25mm, silver anodized aluminum finish or equal. Include metal shelf supports in matching finish.
- H. Work Surface (countertop) Support: "[SWS2 18-1/8" Inter-Arc Work Support](#)" by Doug Mockett & Company. 200lb capacity per bracket.
- I. Round Grommets: "[TG Flip Top Series, 2" hole](#)", by Doug Mockett & Company. Color to be selected by Architect from manufacturer's full line of colors.
 - 1. Provide 2 at each countertop area unless indicated otherwise on Drawings.
 - 2. Final location to be approved by architect in field prior to install.
- J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Stainless Steel: BHMA 630.
- K. Adhesives, General: Do not use adhesives that contain urea formaldehyde.
- L. Keyboard Trays: "SD-4", by Knapp & Vogt.
 - 1. Install per manufacturers recommendations.
 - 2. Final location to be approved by architect in field prior to installation.

2.03 FABRICATION

- A. General: Complete fabrication to maximum extent possible before shipment to Project site. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
 - 1. Interior Woodwork Grade: Custom
 - 2. Shop cut openings to maximum extent possible. Sand edges of cutouts to remove splinters and burrs. Seal edges of openings in countertops with a coat of varnish.
- B. Plastic-Laminate Cabinets:
 - 1. AWI Type of Cabinet Construction: Flush overlay.
 - 2. Laminate Cladding for ALL Surfaces: High-pressure decorative laminate, grade HGS.

3. Colors, Patterns, and Finishes: As selected by Architect from laminate manufacturer's full range.
- C. Plastic-Laminate Countertops:
 1. High-Pressure Decorative Laminate Grade: HGS.
 2. Colors, Patterns, and Finishes: As selected by Architect from laminate manufacturer's full range.
 3. Edges: provide hardwood edge per Division 6 Section "Interior Finish Carpentry".
 4. Core Material at Sinks: exterior-grade plywood.
- D. Architectural Cabinets and Shelving, Paneling, Standing and Running Trim, Transparent Finish
 1. As specified in Division 6 Section "Interior Finish Carpentry".

2.04 FINISHING

- A. Provide price group 3 for plastic laminate. Final color selection to be made by Architect prior to fabrication.
- B. Finish woodwork per Division 6 Section "Interior Finish Carpentry".

PART 3 EXECUTION

3.01 INSTALLATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas. Examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.
- B. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- C. Install woodwork level, plumb, true, and straight to a tolerance of 1/8 inch in 96 inches. Shim as required with concealed shims.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.

- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.
- G. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c.
- H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

END OF SECTION

SECTION 06.650 QUARTZ SOLID SURFACE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Solid Surface Window Stools
2. Solid Surface Countertops/Millwork

B. Related sections:

1. Section 06.200 - Finish Carpentry
2. Section 06.402 - Interior Architectural Woodwork
3. Section 08.410 - Aluminum Storefront
4. Division 15 - Plumbing

1.02 SUBMITTALS

A. Shop drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.

B. Samples: Submit minimum 2" x 2" (50mm x 50mm) samples. Indicate full range of color and pattern variation. Approved samples will be retained as standards for work.

C. Colors as selected by Owner from Manufacturer's full line of colors.

D. Product data: Indicate product description, fabrication information and compliance with specified performance requirements.

E. Maintenance data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project close-out documents.

1.03 QUALITY ASSURANCE

A. Allowable tolerances:

1. Variation in component size: +/- 1/8" (3mm).
2. Location of openings: +/- 1/8" (3mm) from indicated location.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver no components to project site until areas are ready for installation. Store components indoors prior to installation.

B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

- 1.05 WARRANTY
 - A. Provide manufacturer's 10-year warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Diresco
- B. Approved equals
 - 1. Zodiac by Dupont
 - 2. Caesarstone

2.02 MATERIALS

- A. Material: Homogeneous quartz surfaces material
- B. Window sills - 2 cm (3/4")
 - 1. Color: Premium Pure White A250 - Velvet
- C. Restroom Vanities - 2 cm (3/4")
 - 1. Color: Divinity Black A035 - Polished
- D. Vertical Surfaces - 2 cm (3/4")
 - 1. Color: Premium Pure White A250 - Velvet
- E. Countertops/Millwork Cladding - 2 cm (3/4")
 - 1. Color: Premium Pure White A250 - Velvet

2.03 ACCESSORIES

- A. Joint adhesive: Manufacturer approved adhesive to create color matched seam.
- B. Sink/bowl mounting hardware: Manufacturer's approved bowl clips, brass inserts and fasteners for attachment of undermount sinks/bowls.

2.04 FABRICATION

- A. For warranty coverage, fabricator/installer shall be approved by manufacturer.
- B. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer requirements.
- C. Form joints between components using manufacturer's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Reinforce as required.
- D. Provide factory cutouts for plumbing and bath accessories as indicated on the drawings.

- E. Rout and finish component edges to a smooth, uniform finish. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.
- F. Finish: All surfaces shall have uniform finish.

PART 3 EXECUTION

3.01 JOB MOCK-UP

- A. Prior to final approval of shop drawings, erect one full-size mock-up of each component at project site for Architect review.
- B. Should mock-up not be approved, rework or remake until approval is secured. Remove rejected units from project site.
- C. Approved mock-ups shall remain as part of finished work.

3.02 INSTALLATION

- A. Install components plumb and level, in accordance with approved shop drawings and product installation details.
- B. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.
- C. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Components shall be clean on Date of Substantial Completion.
- D. Make plumbing connections in accordance with Division 15, Mechanical.

END OF SECTION

SECTION 07.130 SHEET WATERPROOFING

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following modified bituminous sheet waterproofing and accessories:
1. At all areas where "WP1" is called out on Drawings. This includes, but is not limited to the following:
 - a. Vertical surfaces at below grade concrete beams.
 - b. Horizontal and vertical surfaces of elevator pit.
 - B. Related Sections include the following:
 1. Division 7 Section "Vapor Barriers" for WP2, DP1, and DP2.

1.02 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for waterproofing.

1.03 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1.04 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to replace waterproofing material that does not comply with

requirements or that fails to remain watertight within specified warranty period.

B. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: Not less than 60-mil-thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil-thick, polyethylene film with release liner on adhesive side.

B. Products: Subject to compliance with requirements, provide one of the following:

1. Grace Construction Products; Bituthene 4000 System
2. Meadows, W. R., Inc.; SealTight Mel-Rol
3. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861
4. Tamko Building Products, Inc.; TW-60
5. Soprema Colphene 3000

C. Physical Properties:

1. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
2. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
3. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
4. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
5. Puncture Resistance: 40 lbf minimum; ASTM E 154.
6. Hydrostatic-Head Resistance: 150 feet minimum; ASTM D 5385.
7. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
8. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

2.02 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

- B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of sheet waterproofing material.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- F. Sheet Strips: Self-adhering, rubberized-asphalt sheet strips of same material and thickness as sheet waterproofing.
- G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
- H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.
- I. Protection course: furnish protection course as recommended by the manufacturer for protection of sheet material.
- J. Drainage Mat: Pre-fabricated composite drainage mat with geotextile filter fabric and studded core equal to Hydroduct 220.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- F. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
- G. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.02

APPLICATION

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and according to recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
- D. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.
- E. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic.
- F. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing.
- G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.
- H. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- I. After installation of sheet waterproofing, apply protection course per the following:
 1. Install over entire surface, butt jointed, and, if necessary, temporarily held in place while backfilling.

J. Backfilling

1. Backfilling against vertical walls should be done immediately after installation of protection course using care and caution to avoid damaging the waterproofing application.
2. Backfill material should not be dropped against protection course and sheet waterproofing in such a manner that it could drag the sheet down as the backfill drops.

3.03 PROTECTION AND CLEANING

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07.143 LIQUID APPLIED WATERPROOFING

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes penetrating water-repellent coatings for the following surfaces:
 - 1. Mechanical room floor waterproofing.
- B. The following specification outlines the requirements for a fully reinforced, cold fluid-applied, (PMMA) poly methyl-methacrylate liquid resin waterproofing membrane and all other ancillary waterproofing work for a complete installation.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Data: Provide current standard printed product literature indicating characteristics of membrane materials, flashing materials, components, and accessories product specification and installation.
- C. Product Samples: Submit product samples of membrane and flashing materials showing color, texture, thickness and surfacing representative of the proposed system.

1.03 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing fully reinforced, cold fluid-applied liquid resin waterproofing membrane products as specified in this section with a minimum of five (5) years of documented applications in the United States.
- B. Applicator: Company specializing in performing the work of this section with (3) years documented experience and approved by system manufacturer for warranted membrane installation.
- C. Evaluate moisture content of substrate materials. Constructor shall determine substrate moisture content throughout the work and record with Daily Inspection Reports or other form of reporting acceptable to the Owner or designated Representative, and Membrane Manufacturer.

1.04 WARRANTY

- A. Manufacturer's Standard Warranty: Provide twenty (20) year standard manufacturer's warranty under provisions of this section.
- B. Waterproofing Contractor's Warranty: Provide 2 year "Applicator Maintenance Warranty" covering workmanship for all work of this section including installation of membrane, flashings, metal work, and roofing/waterproofing accessories.
- C. Submit (2) executed copies of both the manufacturer and applicator warranties for the periods stipulated, starting from the date of substantial completion. Each warranty must be signed by an authorized representative of the issuing company.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide "Alsan RS Liquid System" liquid applied waterproofing membrane system as manufactured by Soprema or approved equal. System components shall be as follows (listed in order of application):
 - 1. Primer: Soprema Alsan RS 276 primer
 - 2. Field: Soprema Alsan RS 230 field
 - 3. Fleece: Soprema RS fleece
 - 4. Field: Soprema Alsan RS 230 field

PART 3 EXECUTION

3.01 PREPARATION

- A. New concrete shall have cured a minimum of 28 days in accordance with ACI-308, or as approved by Waterproofing Manufacturer's Technical Department.
- B. New concrete shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, bituminous products and previous waterproofing materials.
- C. Concrete substrate should have a maximum moisture content of 1.5 kg/100m²/24h (ASTM F1869) and internal content of 75% RH (ASTM F2170).
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Start of waterproofing work is acceptance of conditions.

- 3.02 INSTALLATION
- A. Install system in strict accordance with manufacturer's written instructions.
- 3.03 CLEANING
- A. Comply with manufacturer's written cleaning instructions.
- B. Immediately clean waterproofing from adjoining surfaces and surfaces soiled or damaged by application as work progresses. Repair damage caused by waterproofing application.

END OF SECTION

SECTION 07.191 ROOF AND WALL UNDERLAYMENT

PART 1 GENERAL

1.01 SCOPE

A. Includes the roof underlayment at preformed metal roofing, wall panels and as indicated on the plans.

PART 2 PRODUCTS

2.01 PRODUCTS

A. Roof underlayment shall be approved equal to TW Metal and Tile Underlayment (for roofs) as manufactured by Tamko Roofing Products (800) 641-4691. Approved comparable products by:

1. W.R. Grace & Co.
2. Henry Company

B. Membrane must meet or exceed requirements for ASTM D-1970 for nail sealability of self-adhering underlayments.

C. Membrane shall be a flexible, fiberglass reinforced, self-adhering rubberized asphalt sheet membrane with a polymer film on the surface and a removable treated release film on the adhesive side.

D. Membrane characteristics

1. Thickness: 75 mil (roof)

PART 3 EXECUTION

3.01 EXISTING CONDITIONS

A. Inspect all surfaces to which membrane will be applied. Correct any conditions which might adversely affect the proper application of the vapor barrier.

3.02 INSTALLATION

A. Apply Underlayment from low to high point in shingle fashion, so that laps will shed water. Overlap edge seams 4". End seams should be overlapped 6" and staggered. For wrinkle-free application, unroll and cut the membrane into 10- to 15-foot lengths. Align the membrane on the lower edge of the roof. Remove the release film from the membrane then press the membrane into place. Roll lower edges firmly with a wallpaper roller or other hand roller; "Broom in" the

installed membrane using an industrial flat broom or squeegee. Bear down on the installed membrane with the broom or squeegee to insure total, even adherence to the substrate. Care should be taken not to damage the surface when brooming.

- B. For valleys and ridges: Cut membrane into 4- to 6-lengths. Peel the release film and center sheet over valley or ridge. Drape and press sheet into place, working from the center of the valley or ridge outward in each direction. For valleys, apply the membrane starting at the lowest point and work upward. Overlap all sheets a minimum of 6 inches. The TW Metal and Tile Underlayment should be used on "closed valley" applications only. TW Metal and Tile Underlayment should not be left permanently exposed to the weather. It must be covered by roofing materials.
- C. At walls, membrane shall be horizontally applied with minimum 4" laps horizontally and vertically. The top edge of wall underlayment shall be mechanically fastened, beneath the ply lap above, at 6" o.c.
- D. Installation shall be in strict accordance with the manufacturer's written instructions.
- E. Installation shall be in strict accordance with the manufacturer's written recommendations. Refer to the manufacturer's standard details, i.e. TW-1 and TW-10.

END OF SECTION

SECTION 07.210 BUILDING INSULATION

PART 1 GENERAL

1.01 SUMMARY

- A. Extent of insulation work is shown on Drawings, by generic names or by abbreviations.
- B. Applications of insulation specified in this section include:
 - 1. Thermal blanket-type building insulation.
 - 2. Sound attenuation batts in interior metal stud walls, above ceilings and in other locations indicated on the Drawings.
 - 3. Rigid Insulation
- C. Related Sections include the following:
 - 1. Division 4 Section "Unit Masonry" for insulation behind brick.
 - 2. Division 7 Section "Modified Bituminous Membrane Roofing" for insulation under modified bituminous roofing.
 - 3. Division 7 Section "Rigid Roof Insulation".

1.02 SUBMITTALS

- A. Product Data: Product literature, samples and installation instructions for specified insulation.

1.03 QUALITY ASSURANCE

- A. Use insulation of thickness required to provide specified Resistance "R" value.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Do not allow insulation materials to become wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Johns Manville
- B. Knauf (EcoBatt)
- C. CertainTeed (Sustainable Insulation)

2.02 MATERIALS

- A. Thermal Batt Insulation
 - 1. Unfaced fiberglass batt insulation, Johns Manville Unfaced Formaldehyde-free Thermal and

- Acoustical Fiber Glass Insulation or approved equal:
 - a. ASTM Standard C665, Type 1
 - b. Surface burning Characteristics (ASTM E84)
 - (1) Flame Spread 25 or less
 - (2) Smoke Developed 50 or less
 - c. Minimum 20% recycled content
 - d. Size
 - (1) Thickness: Unless otherwise noted provide same thickness as that of wall.
 - (2) Width: Unless otherwise noted provide same as framing spacing indicated.
- 2. Minimum R-Values
 - a. 3-1/2" - R11
 - b. 5-1/2" - R21
 - c. 7-1/2" - R25
- B. Sound Attenuation Batts
 - 1. Sound Attenuation Batts, Johns Manville Formaldehyde-free Sound Control Fiber Glass Batts or approved equal.
 - a. Provide at all interior walls
 - b. Provide above interior ceilings as indicated.
 - 2. ASTM Standard C665, Type 1
 - 3. Surface burning Characteristics (ASTM E84)
 - a. Flame Spread 25 or less
 - b. Smoke Developed 50 or less
 - 4. Minimum 20% recycled content
 - 5. Size:
 - a. Thickness: as indicated on Drawings.
 - b. Width: unless otherwise noted provide same as framing spacing indicated.
- C. Rigid Wall Insulation
 - 1. Extruded polystyrene plastic board insulation, ASTM C578. Rigid closed-cell, with 25 psi compressive strength; 1.0% maximum water absorption; manufacturer's standard lengths and widths, thickness as indicated on Drawings, 4 x 8 foot sheets scored 16 and 24 inches on center. R-5 per inch minimum.
 - a. Furnish "Styrofoam Brand Scoreboard" as manufactured by The Dow Chemical Co., "Foamular 150" as manufactured by Owens Corning or equal.
 - 2. Rigid wall insulation at interior mechanical foam walls to be equal to Owens-Corning Quiet R Duct Board with reinforced aluminum (FRK) facing. Seal all joints - mechanically fastened.

- D. Closed-cell polyurethane blown foam insulation on interior attic walls and under roof deck as shown on the drawings equal to Foam-Lok cc by Lapolla Industries, Inc., 15402 Vantage Parkway east, Houston, TX 77032, (888) 4-lapolla, www.lapolla.com. 3" thick
- E. Accessories
 - 1. Low expansion foam: provide "Green Series Pro-Foam II" as manufactured by OSI (www.osipro.com)
 - a. VOC Level: 0 g/L
 - b. Contains no formaldehyde
- F. Acoustical Blanket Material
 - 1. Provide Selectound Acoustic Blanket by Owens Corning, 2" thick or approved equal. Color to be black.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Installer must examine substrate 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 a manner acceptable to installer.

3.02 INSTALLATION

A. General

- 1. 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.
 - a. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation.
 - b. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

B. Thermal Batt Insulation

- 1. Fill all cracks around doors and windows with expanding spray foam insulation.
- 2. Position to fit snugly between studs.
- 3. Install insulation at all cracks around doors.

4. Place insulation around pipes to prevent freezing and fit neatly around and behind electrical boxes. Leave no gaps.
- C. Sound Attenuation Batts
1. Interior Walls
 - a. Position to fit snugly between studs.
 - b. Install batts at all cracks around doors.
 - c. Staple unfaced insulation to gypsum board with a least five 9/16 inch long staples driven through 1-1/2 inch long pieces of gypsum board joint reinforcement placed on face of insulation to hold insulation in place, or use proprietary fastening system manufactured for this purpose.
 - d. In areas where it will be applied in heights over 8 feet, use wire, metal straps, or other proprietary fastening system to hold the product in place until the interior finish is applied.
 2. Interior Ceilings
 - a. Lay on top of ceiling panel and suspension system. Fit tightly together to reduce the amount of heat loss. Do not install on top of or within 3 inches of recessed light fixtures unless the fixtures are approved for such use.
- D. Rigid Insulation
1. Install where indicated on drawings with compatible adhesive.
- E. Accessories
1. Low expansion foam
 - a. Cover surfaces not intended to be foamed.
 - b. Perimeter seal all openings. Fill to only 30% of area
 - c. Cured foam can be trimmed with a sharp knife or sanded.
- F. Acoustical Blanket Material
1. Install blankets to underside of concrete slab using construction adhesive. When installing with adhesive, follow manufacturer's recommendations for surface preparation and pattern prior to installation.

3.03 CLEANING

- A. Remove and recycle all excess material.
1. Plan and coordinate the insulation work to minimize the generation of offcuts and waste.

Reuse insulation scraps to the maximum extent feasible.

2. Place empty containers of expansion foam in normal disposal areas.

END OF SECTION

SECTION 07.212 RIGID ROOF INSULATION

PART 1 GENERAL

1.01 EXTENT

- A. Includes furnishing and installing rigid insulation on roof decks as indicated on the Drawings.
- B. The roof insulation shall comply with requirements and recommendations of the preformed metal roofing, modified bitumen membrane roofing system, and deck manufacturers.

1.02 GUARANTEE

- A. Insulation shall be included in the roofing system guarantee described in Section 07.535, Modified Bitumen Membrane Roofing System. All materials and installation shall conform to the requirements of that guarantee.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Basis of Design: Johns Manville. Approved comparable products by:
 - 1. Soprema
 - 2. Henry Company
- B. Mechanical Fasteners: As recommended by the roofing and insulation manufacturers for metal deck.
- C. Type III, steep asphalt.
- D. Polyisocyanurate insulation shall be equal to E'NRG'Y 2 rigid board insulation by Johns Manville.
- G. Tapered insulation system shall be equal to E'NRG'Y 2 tapered insulation by Johns Manville. Slope shall be 1/4" per foot. Fill board shall be equal to E'NRG'Y 2 Polyisocyanurate board.

2.02 BENEATH MODIFIED BITUMEN ROOF - OVER CONCRETE DECK - TAPERED

- A. Tapered insulation system, 1/4" per foot, mop applied, 1/8" per foot under raised paver systems.
- B. 1/2" cover board, mop applied.

2.03 BENEATH PREFORMED METAL ROOFING - OVER METAL DECK - NON-TAPERED

- A. Insulation: 4" thick E'NRG'Y Board, mechanically fastened. Install 4" insulation in two layers.
- B. Roof underlayment/ See Section 07.190.

2.04 CRICKETS

- A. Cricket insulation shall be tapered, rate of slope as indicated, polyisocyanurate, faced.

PART 3 EXECUTION

3.01 UPLIFT REQUIREMENTS

- A. Mechanical Fasteners, as approved by the roofing manufacturer, for the metal roof deck. Fastener pattern as required for 115 mph wind speed.

3.02 PROTECTION

- A. Installed insulation shall not be left exposed to the weather. It shall be covered and waterproofed at once. All exposed edges left at the end of the days work shall be temporarily sealed by lapping roofing material or an extra strip of roofing over the exposed edges of the insulation, and mopping it in place. Remove when work resumes.
- B. Installed insulation which has become wet shall be removed and replaced with dry material unless it can be dried out. Applied insulation and completed roofing shall be protected at all times against damage by roof traffic. Plywood or other means should be used to prevent construction damage and walkways where permanent traffic will occur.
- C. Membrane roofing shall not be applied over wet insulation.

3.03 INSTALLATION

- A. Installation shall be in strict accordance with the manufacturer's written recommendations as described in Johns Manville Specifications.
- B. See Section 07.535, Modified Bitumen Membrane Roof System.

END OF SECTION

SECTION 07.260 VAPOR BARRIERS

PART 1 GENERAL

1.01 SUMMARY

- A. Provide total air/vapor barrier systems to complete the Work as shown on the Drawings and as specified herein to bridge and seal air leakage pathways and gaps:
 - 1. Under Slab Vapor Barrier (DP1)
 - 2. Liquid Applied Wall Membrane (DP2)
 - 3. Self-adhering Flashing Membrane (WP2)
- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in Place Concrete"
 - 2. Division 4 Section "Unit Masonry"
 - 3. Division 6 Section "Rough Carpentry"
 - 4. Division 7 Section "Sheet Waterproofing" for WP1
 - 5. Division 7 Section "Flashing and Sheet Metal" for termination bars and other metal flashing accessories.

1.02 SUBMITTALS

- A. Product Data
 - 1. Submit Spec-Data, details and installation procedures.
 - 2. Manufacturer's installation instructions for placement, seaming and penetration repair instructions.
- B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
- C. Include details of interfaces with other materials that form part of air barrier.
- D. Test Reports: Indicating compliance with the performance requirements of this section.
- E. Samples: Submit representative samples of all components as specified herein for approval.

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with manufacturer's written instructions and this specification.

- B. Maintain one copy of manufacturer's written instructions on site.
- C. Systems used shall contain components from one manufacturer only (example: sheet membrane, air barrier sealants, primers, mastics, and adhesives).
NOTE: Different manufacturers may be used for different systems.
- D. Provide products which comply with all federal, state and local regulations controlling use of volatile organic compounds (VOCs).
- E. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Preinstallation conference shall include the Contractor, installer, Architect, and system manufacturer's field representative. Agenda for meeting shall include but not be limited to the following:
 - 1. Review of submittals.
 - 2. Review of surface preparation, minimum curing period and installation procedures.
 - 3. Review of special details and flashings.
 - 4. Sequence of construction, responsibilities and schedule for subsequent operations.
 - 5. Review of inspection, testing, protection and repair procedures.
- F. Provide an independent laboratory per Division 1 Section "Testing Laboratory Services" to perform field tests as specified herein in Part 3.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's recommendations for storage and handling of each product.
- B. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.
- C. Store roll materials on end in original packaging. Protect rolls from direct sunlight until ready for use.
- D. Store air barrier membranes, adhesives and primers at temperatures of 40 degrees F and rising.
- E. Keep solvent away from open flame or excessive heat.

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1.05 PROJECT CONDITIONS

A. Environmental Limitations: Apply vapor and air barriers within the range of ambient and substrate temperatures recommended by manufacturer. Protect substrates from environmental conditions that affect performance. Do not apply barriers to a wet substrate or during snow, rain, fog, or mist.

1.06 WARRANTY

A. Material Warranty

1. Manufacturer's standard form in which manufacturer agrees to replace membrane materials that fail within specified warranty period when installed and used in strict conformance with written manufacturer's instructions.
 - a. Minimum 10 year product warranty required.

PART 2 PRODUCTS

2.01 UNDER SLAB VAPOR BARRIER (DP1)

A. Vapor Barrier

1. Vapor Barrier must have the following qualities:
 - a. Permeance of less than 0.01 perms as tested in accordance with ASTM E 1745 Section 7.
 - b. Other performance criteria:
 - (1) Strength: ASTM E 1745 Class A.
 - (2) Thickness: 15 mils minimum
2. Vapor Barrier Products:
 - a. "Stego Wrap (15 mil yellow)"; Stego Industries.
 - b. "Vaporblock VB15 (15 mil blue)"; Raven Industries.
 - c. "Viper II (15-mil blue)"; Insulation Solutions.

B. Accessories

1. Seam Tape
 - a. Water Vapor Transmission Rate: ASTM E 96, 0.3 perms or lower
 - b. Equal to "Stego Tape" by Stego Industries
2. Vapor Proofing Mastic
 - a. Water Vapor Transmission Rate: ASTM E 96, 0.3 perms or lower
 - b. Equal to "Stego Mastic" by Stego Industries

- 2.02 LIQUID APPLIED WALL MEMBRANE (DP2) - WALL UNDERLAYMENT
- A. A fluid applied, one component acrylic membrane, self-curing,
 - B. Product shall have the following minimum physical properties:
 - 1. Air Permeance: ASTM E2178: Not to exceed 0.0004 cfm/sq. ft. under a pressure differential of 0.3 in. water (1.57 psf).
 - 2. Assembly Performance: Provide a continuous air barrier assembly that has an air leakage not to exceed 0.0008 cfm/sq. ft. of surface area under a pressure differential of 0.3 in. water (1.57 psf) when tested in accordance with ASTM E2357.
 - 3. Membrane Water Vapor Permeance: ASTM E96, Method BW: less than 11.2 perms
 - 4. Peel Adhesion to Concrete: ASTM D4541: 200 psi
 - 5. Pull Adhesion to Glass Faced Wall Board: ASTM D4541: 50 psi
 - C. Products
 - 1. "Perm-A-Barrier VP"; Grace Construction Products
 - 2. "Air-Shield LMP"; W.R. Meadows
 - 3. "Tyvek Fluid Applied WB"; E.I. DuPont de Nemours and Co.

- 2.02 SELF ADHERING FLASHING MEMBRANE (WP2)
- A. Location: Provide around windows, doors, and other openings whether indicated on drawings or not, and all other areas indicated to receive "WP2".
 - B. Product:
 - 1. "Perm-A-Barrier Wall Flashing"; Grace Construction Products.
 - 2. "Air-Shield Thru Wall Flashing"; W.R. Meadows
 - 3. "Blueskin TWF"; Henry Company
 - C. Description:
 - 1. 1 mm (40 mil) of self-adhesive, cold applied tape consisting of 0.8 mm (32 mil) of rubberized asphalt integrally bonded to a 0.2 (8 mil) high density, cross laminated polyethylene film. Membrane shall be interleaved with disposable silicone-coated release paper until installed.
 - D. Water Vapor Transmission: ASTM E 96, Method B (12 perms) maximum.
 - E. Water Absorption: ASTM D 570 Max. 0.1% by weight
 - F. Puncture Resistance: ASTM E 154 178 N (40 lbs.)

- G. Tear Resistance
 - 1. Initiation ASTM D 1004 min. 58 N (13.0 lbs.) M.D.
 - 2. Propagation ASTM D 1938 min. 40 N (9.0 lbs.) M.D.
- H. Lap Adhesion at -4°C (25°F): ASTM D 1876 875 N/m (60 lbs. /ft.) of width.
- I. Low Temperature Flexibility ASTM D 1970 Unaffected to -43°C (-45°F).
- J. Tensile Strength: ASTM D 412, Die C Modified: Min. 5500 kPa (800 psi).
- K. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D 412 Die C Min. 200%.

2.03 ACCESSORIES

- A. Provide all accessories for a complete system application.
- B. Provide stainless steel termination bars per Division 7 Section "Flashing and Sheet Metal" where sheet goods terminate on CMU or concrete.
- C. Surface Conditioner (Primer):
 - 1. Provide manufacturer's standard, equal to "Perm-A-Barrier WB Primer" manufactured by Grace Construction Products
 - 2. Description: Water-based primer which imparts an aggressive, high tack finish on the treated substrate.
 - a. Flash Point: No flash to boiling point
 - b. Solvent Type: Water
 - c. VOC Content: Not to exceed 10 g/L
 - d. Application Temperature: -4°C (25°F) and above
 - e. Freezing point (as packaged): -7°C (21°F)
- D. Termination Mastic:
 - 1. Provide manufacturer's standard, equal to "Bituthene Mastic" manufactured by Grace Construction Products
 - 2. Description: Rubberized asphalt-based mastic with 200 g/l max VOC Content.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrates and conditions are ready to accept the Work of this section. Notify architect in writing of any discrepancies. Commencement of the

Work or any parts thereof shall mean acceptance of the prepared substrates.

- B. All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants detrimental to the adhesion of the membranes. Fill voids, gaps and spalled areas in substrate to provide an even plane. Strike masonry joints full-flush.
- C. Curing compounds or release agents used in concrete construction must be resin based without oil, wax or pigments.

3.02 PREPARATION

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the system.
- B. Exterior sheathing panels
 - 1. Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws. Pre-treat all board joints with 2-3 inch wide, manufacturer's recommended mesh-style (fiberglass) tape. Gaps greater than 1/4 inch, but less than 1/2 inch should be filled with mastic or caulk, allowing sufficient time to fully cure before application of the mesh-style tape and air barrier system.
 - a. Refer to Division 9 Section "Gypsum Board Assemblies" for additional information.
- C. Concrete/Masonry Substrates:
 - 1. Apply air and vapor barrier over concrete block and brick with smooth trowel-cut mortar joints, struck full and flush. Fill all voids and holes, particularly in the mortar joints, with a lean mortar mix, non-shrinking grout or parge coat.
 - 2. New concrete should be cured for a minimum of 14 days and must be dry before air/vapor barrier membranes are applied.

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3. Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D4258 before coating surfaces.
 4. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.
 5. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- D. Liquid applied only: Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- E. At changes in substrate plane, apply sealant or manufacturer's standard liquid membrane at sharp corners and edges to form a smooth transition from one plane to another.
- F. Cover gaps greater than 1/2 inch and form a smooth transition from one substrate plane to another with min 22 gauge stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- G. Apply primer at rate recommended by manufacturer to all areas to receive self-adhering sheet air/vapor barrier membrane and or through-wall flashing membrane as indicated on drawings by roller or spray and allow minimum 30 minute open time. Primed surfaces not covered by self-adhering membrane or self-adhering through-wall flashing membrane during the same working day must be re-primed.

3.03 INSTALLATION

A. General

1. Install air & vapor barrier to dry surfaces at air and surface temperatures of 40°F and above in accordance with manufacturer's recommendations, at locations indicated on Drawings.
2. Do not allow rubberized asphalt surfaces to come in contact with polysulfide sealants, creosote, uncured coal tar products or EPDM.

B. Under Slab Vapor Barrier (DP1):

1. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643-98.

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2. Unroll Vapor Barrier/Retarder with the longest dimension parallel with the direction of the pour.
 3. Lap Vapor Barrier/Retarder over footings and seal to foundation walls.
 4. Overlap joints 6 inches and seal with manufacturer's approved tape.
 5. Seal all penetrations per manufacturer's instructions.
 6. No penetration of the Vapor Barrier/Retarder is allowed except for reinforcing steel and permanent utilities.
 7. Repair damaged areas by cutting patches of Vapor Barrier/Retarder, overlapping damaged area 6 inches and taping all four sides with tape.
- C. Liquid Applied Wall Membrane (DP2):
1. Apply air barrier membrane to achieve a continuous air barrier according to air barrier manufacturer's written instructions.
 - a. Apply air barrier membrane within manufacturer's recommended application temperature ranges.
 2. Spray or trowel apply a continuous uniform film at min. 60 mils (1.5 mm or .060 in.) dry film thickness using multiple, overlapping passes.
 - a. When spraying use a cross-hatching technique (alternating horizontal and vertical passes) to ensure even thickness and coverage.
 - b. When spraying use high pressure, multi-component, airless spray equipment approved by material manufacturer.
 3. Carry membrane into any openings a minimum of 2 inches.
 4. Seal all brick-ties and other penetrations as work progresses.
 5. Do not cover air barrier until it has approved by Independent Testing Agency in writing. Refer to field tests required as specified herein.
 6. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.
 7. After allowing the liquid applied membrane to cure to tack-free, apply self-adhering flashing membrane (WP2) as specified herein.

D. Self-adhering Flashing Membrane (WP2):

1. Install as thru-wall water stop in exterior walls above and around all openings, at all breaks in masonry back-up, at wall base, and all other locations indicated on Drawings.
2. Installation: All surfaces to receive the flashing shall be reasonably smooth, free from irregularities and deleterious materials. On all horizontal surfaces the flashing shall be laid either in a fresh bed of mortar above and below or a trowel coat of mastic. Vertical surfaces shall be pressed firmly in place by hand roller.
3. Over Concrete Foundations: The flashing shall be laid either in a fresh bed of mortar above and below or a trowel coat of mastic. At the intersection with column, the flashing should be brought a minimum of 10" up the column only and not on sides of column and secured with a metal termination bar and sealant.
4. Spandrels: Flashing shall start at the outside toe of the shelf angle, go up the face of the beam and through the wall turning up on the inside face of the wall not less than 2" and be secured with a metal termination bar and sealant.
5. Around openings: Flashing shall start ½" from outside face of wall, then through the wall turning up at the inside not less than 6" and extend 6" on each side of the opening. It shall be turned at the ends forming a 2" deep pan running entirely through the wall. Flashing shall be secured with a metal termination bar and sealant.
6. Thru-Wall: Flashing shall start ½" from the outside face of wall, then go through wall turning up at the inside not less than 2" and be secured with a metal termination bar and sealant.
7. Coping: Flashing shall be laid in a fresh bed of mortar above and below and shall come within ½" of the faces of the wall.
8. Joints: The material shall be lapped at least 2" and rolled with a steel hand roller.

E. Termination Sealant

1. Seal membrane terminations, seams, cuts, heads of mechanical fasteners, masonry tie fasteners, around penetrations, duct work, electrical and

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other apparatus extending through the primary water resistive air barrier membrane and around the perimeter edge of membrane terminations at window and door frames with specified termination sealant.

3.04 FIELD QUALITY CONTROL

- A. Inspections: Air barrier materials and installation are to be inspected by an Independent Laboratory for compliance with manufacturer and project requirements. Inspections to include the following:
1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
 2. Continuous structural support of air barrier system has been provided.
 3. Site conditions for application temperature and dryness of substrates have been maintained.
 4. Maximum exposure time of materials to UV deterioration has not been exceeded.
 5. Surfaces have been primed, if applicable.
 6. Laps in strips and transition membrane have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fish-mouths.
 7. Termination sealant has been applied on cut edges.
 8. Strips and transition membrane have been firmly adhered to substrate.
 9. Compatible materials have been used.
 10. Transitions at changes in direction and structural support at gaps have been provided.
 11. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
 12. All penetrations have been sealed.
- B. Remove and replace deficient air barrier components and reinspect as specified above.

3.05 PROTECTION

- A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - 1. Repair holes, fishmouths, tears, and damage to membrane with a round patch of membrane extending past the damaged area 6 inches in all directions. If fasteners are removed leaving holes in the membrane, they must be patched.
- B. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer.
 - 1. Remove and replace air barrier material exposed for more than 30 days.
- C. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- D. Remove masking materials after installation.

END OF SECTION

SECTION 07.400 PREFORMED METAL ROOF

PART 1 GENERAL

1.01 GENERAL

A. Work shall include a complete installed roof with all associated accessories.

1.02 DESCRIPTION

A. Supply all materials, labor, equipment, services, and perform all work in connection with the furnishing and installing of an architectural standing seam metal roofing system, in accordance with the drawings and specifications, and including but not limited to the following:

1. Preformed and prefinished metal roofing system.
2. Include all flashing, trim, ridge and eave closures as applicable, fasteners, and sealants required for a complete roofing system.
3. Structural clips
4. Workmanship
5. Delivery, Samples and Shop Drawings
6. Guarantee and Warranty

1.03 QUALITY ASSURANCE

A. Manufacturers Qualifications: The roof system manufacturer shall meet and provide written certification stating:

1. The manufacturer shall have been engaged in the design and fabrication of an approved standing seam roof system for a minimum of ten (10) years.

B. Contractor Qualifications: The roof installer shall meet and provide written certification stating:

1. The installer shall have been actively installing the type of roofing system defined in these specification for a minimum of five (5) years.
2. The installer must have completed three (3) projects of equal magnitude.
3. The installer must be certified by the roofing manufacturer for installation of this roof.

C. Design Criteria

1. The following standards and criteria (of most recent issue) shall be used where applicable in

- the structural design of the roofing system covered by this specification:
- a. Manual of Steel Construction, American Institute of Steel Construction.
 - b. Cold Formed Design Manual, American Iron and Steel Institute.
 - c. Test for Wind Uplift Resistance of Roof Assemblies, Underwriters Lab.
 - d. Architectural Sheet Metal Manual, SMACNA.
 - e. The International Building Code as applicable.
2. Design Loads: Design Loads to be considered as follows:
- a. The manufacturer of the metal roof system shall design an engineered roofing system, to include insulation board, roofing underlayment and prefinished metal roof (see Part 2 of this specification). Wind design data shall be:
 - Basic Wind Speed (3 second gust), 115 mph
 - Wind Importance Factor: II
 - Wind Exposure: C
 - Internal Pressure Coefficient: +/- .55
(Partially Enclosed)
 - See Drawing S1.00 for Components and Cladding Pressures

1.04 SUBMITTALS AND PROPOSAL DRAWINGS

A. Requirements

1. Submit for approval descriptive data on all material to be provided. Data shall be sufficient to indicate conformance to specified requirements.
2. Submit for approval required pull-out values and uplift reactions at each type member connection with the roof/structural systems. Shop drawings must be stamped by a structural engineer registered in the State of Mississippi.
3. Submit complete drawings of the system design, clearly indicating scope of work. Include details required to identify the substructural system including fastener type and spacing for attachment to structure, roof panels, typical flashings, and accessories.
4. Submit manufacturer's specifications on all sealants.
5. Submit applicable sample warranties of products with bid proposals.

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6. Submit manufacturer's suggested material handling and material protection requirements.

1.05 WARRANTIES

A. Pre-printed Baked-on Finish

1. Excessive color change and chalking shall be warranted for a period of twenty (20) years. Color change shall not exceed 5 NBS Hunter units per ASTM D 2244, no chalking greater than #8 rating, per ASTM D 659-80.
2. Freedom from cracking, chipping or peeling due to deterioration of the finish for a period of 20 years from the date of purchase, exclusive of mechanical damage or other abnormal contingencies.

B. Weathertightness

1. The entire installation shall be guaranteed weathertight for a minimum period of twenty (20) years. Provide written warranty agreeing to replace/repair defective materials during the warranty period. The weathertightness warranty shall be a 20-year, full system, single source, no dollar limit.

PART 2 PRODUCTS

2.01 ROOF SYSTEM

- A. Standing seam metal roof system shall be Berridge Zee-Lock Double Lock System as manufactured by Berridge Manufacturing Co., Houston, Texas. Approved comparable products by:
 1. IMETCO
 2. Fabral
- B. Roof Panels shall be roll formed in continuous lengths. Seam spacing shall be 16" on center. Double Lock Seam to be formed with Berridge Seaming Machine. Certification shall be submitted, based on independent testing laboratory, indicating no measurable water penetration through the standing seam system when tested in accordance with ASTM E331-86 and E283-84. Material shall be 24 gauge prefinished galvalume, ASTM-792-86.
- C. Finish shall be Kynar 500 or Hylar 5000 Fluorocarbon coating with a top side film thickness of 0.80 to 0.90 mil over 0.20 to 0.25 mil prime coat, to provide a total dry film thickness of 1.0 to 1.15 mil. The

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reverse side shall be coated with a backer coating of 0.25 mil nominal dry thickness. Finish shall conform to all tests for adhesion, flexibility and longevity as specified by finish provider. Color to be selected from the manufacturer's full range of colors.

- D. Strippable protective coating shall be factory applied, and removed immediately prior to installation. All exposed flashing and sheetmetal shall be of the same material and finish as panel system.
- E. Roof Panel system shall be attached to substrate using continuous Zee clips mechanically fastened to structural metal deck (through rigid insulation) at 12" on center maximum. Exposed screws, at the underside of the structural metal deck, shall be cut off with the remaining exposed length to be 1/2" or less. Ensure panel clips provide for thermal movement.
- F. Seamed joints shall include proper weatherseal component.
- G. Metal roof trim shall be prefinished metal to match metal roof panels. Trim shall be continuous at all roof edges, ridges, valleys, etc., and have the same finish warranty.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection

1. Inspect installed work of other trades and verify that such work is complete to a point where this work may commence.
2. Verify that installation may be made in accordance with approved shop drawings and manufacturer's instructions.

B. Discrepancies

1. In the event of a discrepancies, notify the owner.
2. Do not proceed with installation until discrepancies have been resolved.

3.02 INSTALLATION

- A. Install all components within this section where indicated on the shop drawings, anchoring all components firmly in place in complete accordance

with the project drawings, approved shop drawings, and the manufacturers recommendations.

1. Install all materials in strict accordance with the manufacturer's instructions, best trade practices and in a manner to provide a complete watertight installation.
2. Provide fastenings, expansion joints, cleats and all other accessories for a complete installation.
3. All components not furnished by the system manufacturer but incorporated into the work shall be installed in accordance with the manufacturer's instructions in a manor acceptable to the roofing system manufacturer.
4. All work to be performed by a certified contractor and capable of supplying materials and warranties listed in this specification
5. Store all materials per manufacturer's written instructions.
6. All work to create a straight, true, and/or flat finished surface.
7. Contractor is responsible to maintain a clean and neat job site, and pay for removal of all trash generated by this operation.

END OF SECTION

PREFORMED METAL ROOF

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SECTION 07.410 METAL WALL PANELS

PART 1 GENERAL

1.01 SUMMARY

- A. Extent of preformed siding is shown on Drawings (around perimeter of Penthouse).
- B. Type of preformed siding applications specified in this section include the following:
 - 1. Metal wall panels
 - 2. Accessories
- C. Related Sections include the following:
 - 1. Division 7 Section "Prefabricated Coping System".
 - 2. Division 7 Section "Flashing and Sheet Metal".

1.02 DESIGN REQUIREMENTS

- A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Thermal Expansion and Contraction:
 - 1. Completed metal wall panel and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, or reducing performance ability.
 - 2. The design temperature differential shall be not less than 220 degrees Fahrenheit.
 - 3. Interface between panel and clip shall provide for unlimited thermal movement in each direction along the longitudinal direction.
- C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure with no leakage: 5 Gal/Hr per S.F. and Static Air Pressure of 20.0 psf for 15 min.

1.03 SUBMITTALS

- A. Product data including product specifications, test data, performance data, sample warranty, and general recommendations.
- B. Shop drawings: Show wall panel system with flashings and accessories in elevation, sections, and details. Include metal thicknesses and finishes, panel lengths, joining details, anchorage details, flashings and special fabrication provisions for termination and penetrations. Indicate relationships with adjacent and interfacing work. Shop drawings to be prepared by metal wall panel manufacturer and sealed by a professional engineer registered in the state of the project location.
- C. Submit sample of panel section, at least 6" x 6" showing panel profile with factory applied seam sealant, and also a sample of color selected.

1.04 QUALITY ASSURANCE

- A. Engage an experienced metal wall panel contractor (erector) to install wall panel system who has a minimum of three (3) years experience specializing in the installation of metal wall systems.
- B. Contractor must be certified by manufacturer specified as a supplier of the metal wall system and obtain written certification from manufacturer that installer is approved for installation of the specified system.
- C. Successful contractor must obtain all components of wall system from a single manufacturer. Any secondary products that are required which cannot be supplied by the specified manufacturer must be recommended and approved in writing by primary manufacturer prior to bidding.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inspect materials upon delivery, handle materials to prevent damage.
- B. Store materials off ground providing for drainage; under cover providing for air circulation; and protected from any debris.

1.06 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions

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permit metal wall panel work to be performed according to manufacturer's written instructions and warranty requirements.

- B. Field Measurements: Verify actual dimensions of construction contiguous with metal wall panels by field measurements before fabrication.
- C. Coordinate metal wall panels with rain drainage work, flashing, trim, and construction of other adjoining work to provide a leak proof, secure, and noncorrosive installation.

1.07 WARRANTY

- A. Manufacturer's standard 20-year finish warranty covering checking, crazing, peeling, chalking, fading, and adhesion of the prepainted sheet metal materials.
- B. Installer's 2-year warranty covering wall panel system installation and watertightness.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Imetco (Innovative Metals Company)
- B. Architectural Building Components (24 ga Flush Panel, 12" wide, panels stitched together)
- C. Equal as approved

2.02 MATERIALS

- A. Painted, metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - 1. 24 gauge, Zinc-Coated (Galvanized) Steel Sheet, as per ASTM A653: G90 coating designation; structural quality, grade 40 ksi.

2.03 FABRICATION

- A. General: Provide factory-formed metal wall panels designed to be field assembled by interlocking seams incorporating concealed anchor clips, allowing thermal movement.
- B. Concealed clip, interlocking flush seam wall panels.
 - 1. Panel shall be "PermWall 1.5" system as manufactured by Innovative Metals Company, Inc. (Imetco).

METAL WALL PANELS

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2. Characteristics
 - a. Fabrication: Panels shall be factory formed from zinc-coated (galvanized) steel sheet.
 - b. The standard profile shall be striated throughout the panel.
 - c. Panel orientation: Vertical.
3. Configuration: Panel shall be 12-inches wide nominal, with interlocking seams incorporating concealed anchor clips allowing thermal movement.
4. Panel Depth (Concealed Leg Height): 1-1/2 inches, nominal.
5. Anchor clips: Clips shall be 22 gauge galvanized steel designed to allow thermal movement of the panel in each direction along the longitudinal dimension.
6. Panel length: one piece from base to eave required.

2.04 ACCESSORIES

- A. Flashing and Trim: Formed from same material and gauge as wall panels, prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, head, sill, corners, jambs, framed openings, fascia, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.05 FABRICATION

- A. Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Form flashing components from full single width sheet in minimum 10'-0" sections. Provide mitered trim corners, joined using closed end pop rivets and butyl-based, solvent released one-part sealant.

- D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Sealed Joints: Form nonexpanding but movable joints in metal to accommodate butyl-based sealant to comply with SMACNA standards.
 3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 4. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal wall panel manufacturer for application, but not less than thickness of metal being secured.
 5. Coordinate with Division 7 Section "Flashing and Sheet Metal".

2.06 FINISHES

A. Exposed Coil-Coated Finish

1. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Manufacturers' approved applicator to prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Coating system shall provide nominal 1.0 mil dry film thickness, consisting of primer and color coat.
3. Color shall match coping color per Division 7 Section "Prefabricated Coping System"

- B. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of the Work.
- B. Examine primary and secondary wall framing to verify that girts, studs, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal wall panel manufacturer.
- C. Examine locations of existing components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Start of work is acceptance of conditions.

3.02 INSTALLATION

- A. All details will be shown on in accordance with approved shop drawings and manufacturer's product data, within specified erection tolerances.
- B. Installation of Wall Panels: Wall panels can be installed by starting from one end and working towards the opposite end.
- C. Isolate dissimilar metals and masonry or concrete from metals with bituminous coating. Use gasketed fasteners where required to prevent corrosive action between fastener, substrate, and panels.
- D. Seal laps and joints in accordance with wall panel system manufacturer's product data.
- E. Coordinate flashing and sheet metal work to provide weathertight conditions at wall terminations. Fabricate and install in accordance with standards of SMACNA Manual and Division 7 Section "Flashing and Sheet Metal"
- F. Provide for temperature expansion/contraction movement of panels at wall penetrations and wall mounted equipment in accordance with system manufacturer's product data and design calculations.

- G. At joints in linear sheet metal items, set sheet metal items in two 1/4-inch beads of butyl sealant. Extend sealant over all metal surfaces. Mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.
- H. Installed system shall be true to line and plane and free of dents, and physical defects. Remove damaged work and replace with new, undamaged components.

3.03 FIELD QUALITY CONTROL

- A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of 1/4 inch in 20 feet at location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.04 CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

METAL WALL PANELS

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SECTION 07.535 MODIFIED BITUMEN MEMBRANE ROOFING SYSTEM

PART 1 GENERAL

- 1.01 RELATED DOCUMENTS: Drawings and General Provisions of:
A. Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this and all sections.
- 1.02 SCOPE
A. Membrane roofing system includes vapor barrier, rigid insulation base, tapered roof insulation, cover board, modified roof system, membrane flashing, metal flashing, pipe and roof penetrations, and related work. See Section 07.620 for Flashing and Sheet Metal.
- 1.03 QUALITY ASSURANCE
A. Contractor Requirements: Roofing applicator must be qualified to install roofing system specified, or accepted, and must be currently approved by manufacturer of roofing materials to be installed. The roofing contractor shall have been in business not less than 5 years. The apparent low bidder shall provide, within ten (10) days, to the Owner, a letter from the manufacturer of the required roofing materials of which he is an authorized installer and he shall list three (3) projects installed by his firm using the type roofing specified.
B. Resolution of Conflicts: Immediately refer to Architect for resolution between conflicts of drawings and specifications, regulatory agencies, material manufacturer's recommendations, and good roofing practices.
C. Requirements of Regulatory Agencies:
1. U.L. Built-up Roof Covering: Fire Hazard Classification Class A.
2. Follow local, state and federal regulations, safety standards and codes. When conflict exists, use stricter document.
3. F.M. Assembly Classification, to meet wind speed requirements for the project location, in accordance with the latest edition of the International Building Code.
D. Contractor shall be responsible for meeting, or exceeding, Factory Mutual (FM) requirements for wind uplift loading. Any required changes to the roofing

MODIFIED BITUMEN MEMBRANE ROOFING SYSTEM

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systems herein shall be at NO ADDITIONAL EXPENSE TO THE OWNER.

- E. Roof Manufacturer's Inspection: Prior to, during installation and at completion of the installation, an inspection shall be made by a representative of the manufacturer in order to ascertain that the roofing system has been installed according to their published specifications, standards and details. A complete inspection shall be performed after modified bitumen base sheet has been installed, and prior to the installation of the modified bitumen cap sheet. These inspections must be concurrent with the Architect. Manufacturer's inspector must give sufficient notice of the time and dates of his inspections to the Owner, so as to have the Owner's representative present. The manufacturer's inspector will identify all necessary corrections to the roofing system. The manufacturer's inspector shall provide a complete written report, of his findings and recommendations with necessary digital photographs. These reports shall state that the system, as installed complies with the warranty requirements without exception. Copies of these reports shall be sent to the Owner and the Architect, simultaneous with the reports sent to the Contractor.
- F. Owner and Architect shall inspect and approve the top ply of the SBS modified bitumen base sheets, prior to application of the cap sheet (top ply).**

1.04 SUBMITTALS

- A. Include Complete Shop Drawings of:
1. Construction details, finishes and methods of assembling sections;
 2. Size, shape and thickness of materials;
 3. Details of joining with other work;
 4. Rigid roof insulation lay-out shop drawings;
 5. Furnish minimum of 5 copies of all submittals except material samples.
- B. Manufacturer's Literature
1. For information only, submit 5 of most recent copies of manufacturer's specifications and installation instruction for each type of product to be used.
 2. Letter from the proposed roofing manufacturer confirming that the roofer is an acceptable contractor authorized to install the proposed roofing system.

3. By copy of transmittal form, indicate installer has received copy of manufacturer's instructions.
- C. Samples
1. Three sheet samples, 8" x 10", of roofing membranes.
 2. One sample, 8" x 10" of roof insulation materials.
- D. Form of Warranty
1. Submit 2 sample copies of Manufacturer's no dollar limit warranty for each type of roofing system including rigid insulation, modified roofing system, and metal endorsements for roofing and associated work, within 10 days after notice of acceptance of low bid, for approval before signing of contract.
- E. Certificates
1. With product data, submit letter from Roof Material Manufacturer affirming applicator's eligibility for Roof Guarantee, and evidence of applicator's experience.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery and Storage
1. Deliver materials to project in manufacturer's original unopened containers or packages on pallets, properly labeled with material name, production date, and product code for identification, with manufacturer's labels intact and legible.
 2. Provide pallets or dunnage raised 4" above ground level and breathable type covers such as canvas to protect materials from weather and contamination with dirt and debris.
 3. Stack roofing rolls on end under ventilated protective cover and maintain at temperature of at least 50 degrees F. for not less than 24 hours before laying.
 4. Keep insulation dry at all times.
 5. Protect asphalt emulsion materials from freezing.
- B. Handling: Refer to Roof Material Manufacturer's Specifications for additional handling requirements.
- C. Protection
1. Do not allow insulation materials to become wet or soiled or covered with ice or snow.
 2. Comply with each product manufacturer's recommendations for handling, storage and protection during installation.

- D. Restrictions
 - 1. Do not overload building structure with concentrated material storage on roof deck.
 - 2. Damaged, wet, or unsuitable roofing materials will not be approved for installation under any circumstances and must, immediately upon discovery, be removed from project site.
- E. Replacements: In event of damage, immediately make all repairs and replacements necessary to meet Architect's approval and at no additional cost to Owner.

1.06 PRE-ROOFING CONFERENCE

- A. Schedule conference before roofing materials are delivered to project.
- B. Notify for Attendance: Owner, Using Agency representative, Architect, General Contractor, Roofing Contractor's Superintendent and his job foreman, and roofing materials Manufacturer's representative.
- C. Records: Keep records of meeting and discussions made at meeting.
- D. Review in Depth: Project Manual, Detail Drawings, Manufacturer's Specifications and warranty requirements.
 - 1. In detail, discuss construction procedures, job and surface readiness, material storage and protection.
 - 2. Note deviations, differences or discrepancies.
 - 3. Resolve and make part of project record.
 - 4. Review warranty requirements.

1.07 ARCHITECT'S REPRESENTATIVE

- A. Notification of Architect: Architect intends to have his representative present on project prior to beginning roofing operations. Notify Architect of Contractor's intention to begin work no less than 48 hours (2 working days) in advance so arrangements may be made for representative to be present. Do not perform work without notifying Architect, except in emergency conditions; and notify Architect by telephone immediately following any work performed under emergency conditions.
- B. Limitation: Presence of Architect's representative will not in any way relieve Contractor from full compliance with Contract, Drawings and Specifications.

1.08 PROJECT CONDITIONS

- A. Weather Conditions: Install roofing membrane in dry weather and only when predicted weather conditions will insure proper application of all materials required for complete system. Surfaces must be dry and free of foreign materials, snow, ice or any other condition which would interfere with good application practices.
- B. Related Work: Coordinate roof insulation with work specified in other sections which are in contact with roof surfacing or which effect completed roof installation.
- C. Protection: Protect other work from spillage of roofing materials. Replace or restore other work which is soiled or otherwise damaged by performance of roofing and associated work.
 - 1. Properly and efficiently protect building and work of other trades from damage by roofer's materials during performance of work.
 - 2. Replace or restore other work which is soiled or otherwise damaged by performance of roofing and associated work.
 - 3. Before starting work, protect in approved manner all paving and face of building walls adjacent to hoist and kettles. Refer to other specified protective measures. Maintain protection in place for duration of roofing work.
 - 4. Transfer bitumen only to suitable mechanical felt laying machine on rooftop for application.
 - 5. During roofing work, exposed surfaces of finished wall shall be protected with tarps in order to prevent damage. Contractor shall assume full responsibility for any damage. Repairs will be to the satisfaction of the University.
- D. Safety: Familiarize every member of the application crew with all fire and safety regulations by OSHA, NRCA and other industry or local government groups.

1.09 WARRANTY

- A. Applicator's Warranty: At completion of project and prior to final acceptance, the roofing contractor shall furnish in writing and notarized, 5 copies of Roofing Contractor's warranty for all work of the new roof system against both faulty material and workmanship and to be free of water leaks for work two (2) years from date of Owner's acceptance.

1. Address warranty to Owner and deliver to Architect for review and transmittal.
 2. During this two (2) year period, agree to remove, repair and replace all defects, defective materials and generally to maintain roofing system and associated sheet metal and accessories in its original watertight condition, all without cost to Owner. Such warranty should reflect this paragraph verbatim and provisions of warranty as required by Section 01.700 Paragraph(s) 1.03 Close-out Documents, Sub-paragraph F.
- B. Roofing Manufacturer's Warranty: At completion of project and prior to final acceptance, furnish 20 year roofing system material and workmanship no dollar limit system warranty; including insulation, flashing, metalwork endorsements, and all penetrations (including Roof Anchor System).
1. During roof warranty period, manufacturer's representative and roofing contractor agree that as soon as practical after receipt of notice from Owner, they will inspect and cause immediate emergency repairs to be made to defects and leaks threatening interior of building.
 2. Manufacturer and Roofing Contractor further agree to effect permanent repairs to defects or leaks within 30 days of Owner's notice without cost to Owner.
 3. The manufacturer shall review the requirements of the plans, specifications and project prior to bidding. Any conditions which may negatively affect the warranty must be identified in writing prior to bidding. No exception to warranty is acceptable.
- C. Emergency Repairs: Owner reserves prerogative of making immediate emergency repairs, at their own expense, to conditions threatening building contents without abrogating their rights under this warranty.
- D. Type Repairs: Make permanent restoration using proper laminar reconstruction with hot bitumen and reconstruct to original condition using materials and methods originally manufacturer specified or as outlined by manufacturer's written requirements.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Base Specifications are based on products manufactured or supplied by Soprema. Other acceptable manufacturers are Johns-Manville and Henry Company. All details and systems to be as required for 20 year no dollar limit warranty on built-up roofing system, flashing, and associated metals, as described above.
- B. Source: Use products of/or approved by one manufacturer for warranty purpose.

2.02 WIND LOADS

- A. Contractor shall be responsible for meeting, or exceeding, Factory Mutual (FM) requirements for wind uplift loading. Designs shall be based on the requirements in the current edition of the International Building Code. Any required changes to the roofing systems herein shall be at NO ADDITIONAL EXPENSE TO THE OWNER.

2.03 ROOFING MEMBRANES

- A. Vapor Barrier
1. Two (2) plies (mopped)
SOPRALENE 180 SANDED 2.2
JOHNS MANVILLE: DYNABASE PR
- B. Modified Bitumen Base Plies
1. Two (2) plies (mopped)
SOPRALENE 180 SANDED 2.2
JOHNS MANVILLE: DYNABASE PR
- C. Modified Bitumen Top Ply (cold applied)
SOPRALENE 180 FR GR
JOHNS MANVILLE: DYNALASTIC 180 FR
- D. Base Ply Flashing (torched)
SOPRALENE FLAM 180
JOHNS MANVILLE: DYNAWELD 180 S
- E. Top Ply Flashing (torched)
SOPRALAST 50 TV ALU
JOHNS MANVILLE: DYNACLAD

2.04 ROOFING SYSTEMS

- A. Over structural concrete deck
1. Concrete deck primer
2. Vapor Barrier (2 Ply), mop applied
3. Tapered insulation system, 1/4" per foot, mop applied.

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4. 1/2" thick Cover Board, mop applied.
 5. Bottom Ply, mop applied.
 6. Modified bitumen base ply, mop applied.
 7. Modified cap sheet, cold applied.
- 2.05 CANTS AND EDGE STRIPS
- A. Cant Strips to be equal to FesCant Plus, high density, laminated perlite board; and Edge Strips to be equal to Tapered Fesco Edge strips.
- 2.06 INSULATION - **R-30 AVERAGE REQUIRED**
- A. Insulation shall be a rigid board with facing material acceptable to the membrane manufacturer for the system specified.
 1. Acceptable products for Concrete Decking.
 - a. Tapered Polyisocyanurate (1/4" per foot) with a minimum starting edge of 1-1/2" + 1/2" cover board MOPPED.
 - B. Cover Board shall be 1/4" Sopraboard or 1/2" thick Dens-Deck Prime manufactured by Georgia Pacific, or approved equal.
- 2.07 PRIMER
- A. Asphalt Primer: ELASTOCOL 500
 1. Primer shall be applied on all dissimilar materials except insulation.
 2. Description: Black bituminous varnish.
 3. Composition: Asphalt modified bitumen with thermoplastic polymers and volatile solvents.
- 2.08 ASPHALT
- A. Asphalt shall be certified to meet or exceed the requirements of ASTM D312, Type III or Type IV. Each container, or bulk, shipping ticket shall indicate the equiviscous temperature (EVT), the finished blowing temperature (FBT), and the flash point.
- 2.09 ROOFING ADHESIVES
- A. Cold Adhesive: Colply by SOPREMA or equivalent by Johns Manville
- 2.10 LIQUID FLASHING SYSTEM INSTEAD OF PITCH PANS OR POCKETS
- A. SOPREMA: ALSAN FLASHING SYSTEM
 - B. JOHNS MANVILLE: PERMAFLASH FLASHING SYSTEM

2.11 FLASHING BEHIND METAL FASCIA

- A. Lastobond Shield HT by SOPREMA or equivalent supplied by roofing membrane manufacturer. Product must be High Temperature specifically designed to be applied behind metal.

PART 3 EXECUTION

3.01 SURFACE INSPECTION AND PREPARATION

- A. Before commencing work, all surfaces shall be smooth, clean, dry and free of any debris that would adversely affect the installation of the membrane.
- B. Before commencing work, the manufacturer's representative, together with the roofing contractor, shall inspect and approve the deck condition (slopes and nailing supports if applicable) as well as verticals on parapet walls, roof drains, stack vents, vent outlets and others, building joints, etc. If applicable, a noncompliance notice shall be submitted to the contractor so that adjustments can be made. Commencement of work shall imply acceptance of surfaces and conditions.
- C. Verify that the work of other trades has been properly completed.
- D. Do not install materials in conditions of inclement weather.

3.02 SURFACE PREPARATION

- A. Concrete Deck: Verify slope and condition of concrete decking.

3.03 INSTALLATION

- A. Install roofing membrane on clean and dry surfaces, in accordance with the manufacturer's requirements and recommendations.
- B. Apply all layers of roofing perpendicular to slopes of insulation.
- C. Perform roofing work on a continuous basis as surface and weather conditions allow.
- D. Protect adjoining surfaces against any damage that could result from roofing installation.
- E. Install only as much roofing as can be completed in one day. If weather conditions do not permit such completion, exposed areas shall be temporarily weatherproofed to prevent any water or snow infiltration from damaging other materials already installed, in particular, the thermal insulation.

3.04 EQUIPMENT

- A. Maintain all equipment and tools in good working order.
- B. Equip kettles and tankers with accurate, fully readable thermometers. Do not heat asphalt to or above its FP. Avoid heating at or above FBT, should conditions make this impracticable, and exception is granted by the Architect, heating above the FBT must not be done for more than four (4) hours. Application temperatures must not be more or less than 25 degrees F of the EVT.

3.05 ASPHALT PRIMER APPLICATION

- A. Prime all dissimilar surfaces to which asphalt or membrane will come in contact. Apply at the rate of 150 - 200 sq. ft. / gallon. Coat all metal flashings and fascia with primer, which will come in contact with membrane.

3.06 INSTALLATION OF INSULATION

- A. Install insulation in accordance with the Architect or manufacturer's requirements. The insulation shall provide a smooth surface to accept the roof membrane.
- B. Apply only as much insulation to the roof as can be covered the same day with roofing membrane. At the conclusion of each day's work, seal exposed edges of the insulation. Cut and remove seal upon continuation of the work.
- C. Place tapered insulation in accordance with manufacturer's recommendations and according to approved shop drawings.
- D. Taper boards a distance of 18 inches back from roof drains for positive drainage.
- E. Install insulation as required to meet wind load requirements (I-120).

3.07 ASPHALT APPLICATION

- A. For insulation and membrane application apply asphalt at a minimum temperature of approximately 425 degrees F - Type IV. Apply asphalt at a rate of 20-30 lbs./sq. at a distance not to exceed three (3) feet ahead of the roll to provide a sufficient adhesion with the asphalt of the membrane.
- B. For low temperature application, it may be necessary to heat asphalt at higher temperatures so that application temperature is adequate. However, the heating temperature of the asphalt shall not exceed

450 degrees F or the indicated flash point. Care must be taken so the asphalt in the kettle is continuously used to prevent distillation.

3.08 BASE PLIES INSTALLATION

- A. Unroll dry base ply membrane on insulation for alignment. Each strip shall have three (3) inch side laps and six (6) inch end laps.
 - 1. Begin at low point of roof.
 - 2. Place membrane so edge lap will be centered on drain.
- B. Reroll base ply (halfway) one end at a time in accordance with recommendations of the roofing manufacturer, onto an approved substrate.
- C. Roll the membrane into a full width mopping of asphalt. The membrane must be firmly and uniformly set, without voids, into the asphalt, which is applied at a nominal uniform rate of 23 lbs. per square.
- D. The temperature of the asphalt at application should be such that, when the membrane is set its temperature is approximately 20 F above EVT.
- E. Application shall provide a smooth surface, free of air pockets, wrinkles, fishmouths or tears.
- F. Run membrane tight up against any vertical surfaces such as curbs, parapets, and vents.
- G. The "Mop and Flop" technique is not an acceptable installation procedure.

3.09 BASE PLY FLASHING INSTALLATION

- A. Prior to application, the vertical surface receiving the base ply flashing shall receive a coat of primer at the rate of 150-200 sq. ft./gallon. This primer coating must be dry before application of the base sheet flashing.
 - 1. For gusset application refer to 3.22 of this section.
- B. Lay base ply flashing in strips three (3) feet wide to the vertical surfaces, extending onto the flat surface of the roof a minimum of four (4) inches. Side laps shall be three (3) inches and shall be staggered a minimum of four (4) inches with the laps of the base ply.
- C. Mop base ply flashing directly on its support from bottom to top followed by the torching of the roof tie-in.

- D. After installation of base ply flashing, check all lap seams on the flashing by running a heated trowel along the edge of the seams.
 - 1. THOROUGHLY SEAL ALL VOIDS IN THE CORNERS AND SEAMS.
- E. Owner and Architect shall inspect and approve the top ply of the SBS modified bitumen base sheets, prior to application of the cap sheet (top ply).**

3.10 TOP PLY INSTALLATION

- A. Cold Applied Ply: Hot air weld all seams at SBS Modified Bitumen Granulated Cap.
- B. Membrane Application: Apply top ply in accordance with roofing system manufacturer's instructions for cold applied membrane.
- C. Aesthetic Considerations: An aesthetically pleasing overall appearance of the finished roof application is a standard requirement for this project. Make necessary preparations, utilize recommended application techniques, apply the specified materials (i.e. granules, etc.), and exercise care in ensuring that the finished application is acceptable to the Architect and the Owner.
- D. Fully bond the finish ply to the base ply, utilizing minimum 3 inch side and end laps. Stagger end laps of the finish ply a minimum 3 feet. Cut a dog ear angle at the end laps on overlapping selvage edges. Using a clean trowel, apply top pressure to top seal T-laps immediately following sheet application. Stagger side laps of the finish ply a minimum 12 inches from side laps in the underlying base ply. Stagger end laps of the finish ply a minimum 3 feet from end laps in the underlying base ply.
- E. There should be no asphalt seepage due to welded seams.

3.11 TOP PLY FLASHING INSTALLATION

- A. Lay top ply flashing in strips three (3) feet wide.
 - 1. Side laps shall be three (3) inches and shall be staggered a minimum of four (4) inches from top ply laps in order to avoid excessive thickness.
- B. Using a chalk line, lay-out a straight line on the top ply surface, parallel to the roof edge, six (6) inches inside the roof from the base of the cant strip or right angle to be flashed.
- C. Using a torch and hook blade knife remove aluminum facing from the chalk line to the edge of the top ply, and to the top of the cant or right angle,

following the specifications outlined under top ply installation above.

- D. Extend top ply flashing down the vertical surface and onto the flat roof at a distance of six (6) inches, to the extent of the area of removed facing. For ease of application, cut roll into required lengths and use width of roll three (3) feet down length of roof, maintaining specified three (3) inch laps.
 - 1. Torch weld top ply flashing in accordance with recommendations of the roofing manufacturer, directly on its base ply, proceeding from bottom to top followed by the torching of the roof tie-in.
 - 2. Firmly press flashing into position using a damp sponge.
- E. Thoroughly seal all voids in the corners and seams.
- F. Application shall provide a smooth surface, free of air pockets, wrinkles, fish mouths or tears.
- G. During installation, avoid asphalt seepage greater than 1/4 inch at seams.

3.12 LIQUID FLASHING SYSTEM INSTEAD OF PITCH PANS OR POCKETS.

- A. Install liquid flashing system on all penetration and any irregular penetrations.
 - 1. Installation shall be in strict accordance with the manufacturer's written instructions.
 - 2. Clean area.
 - 3. Using paint brush or roller coat penetration with liquid flashing 25 mils per layer.
 - 4. Install flashing scrim two 4" layers
 - 5. Install two additional layers of flashing scrim.
- B. Allow each layer of the liquid flashing to dry 2 to 5 hours before applying each coat.
- C. After the last coat of liquid flashing is applied wait 20 to 30 min and apply granules to the flashing system for granular cap sheet look.

3.13 WATER CUT-OFF

- A. At the end of the day's work, and when precipitation is eminent, a water cut-off shall be constructed at all open edges. Construct the cut-off with the same membrane and asphalt. Cut-off must be able to withstand extended periods of wet weather. The water cut-off shall be completely removed prior to resuming the installation of the roofing system.

3.14 CLEANING

- A. Clean-up and remove daily from the site all wrappings, empty containers, paper, loose particles and other debris resulting from these operations.
- B. Remove asphalt markings from finished surfaces.
- C. Repair or replace defaced or disfigured finishes caused by work of this section.

3.15 PROTECTION

- A. Provide traffic ways, erect barriers, fences, guards, rails, enclosures, chutes and the like to protect personnel, roofs and structures, vehicles and utilities.
- B. Plywood for traffic ways required for material movement over existing roofs shall be not less than 5/8 inch thick.
- C. In addition to the plywood listed above, an underlayment of minimum 1/2-inch recover board is required on new roofing.
 - 1. Special permission must be obtained from the Manufacturer before any traffic will be permitted over new roofing.
- D. Provide walk pads at all roof access points.

3.16 ROOF DRAINS

- A. Provide a smooth transition from drain bowl to deck surface.
 - 1. Taper insulation back from drain a minimum of 18-inches to provide for positive drainage.
 - 2. Prime all metal surfaces, including both sides of the lead.
 - 3. Using a trowel, set a 6-inch wide layer of mastic around the drain bowl edge as water cut-off.
- B. Install base ply membrane with lap centered on bowl and as specified under 3.09 of this section ensuring a tight seal at drain.
 - 1. Install a 30 x 30 inch lead sheet over center of drain.
 - 2. Mop into place a reinforcing sheet of SBS base ply material three feet square centered on drain.
 - 3. Cut back membranes flush with the inside edge of the drain bowl and temporarily secure with clamping ring.
- C. Install top ply as specified under 3.11 of this section.
 - 1. Cut back membrane flush with the inside edge of the drain bowl.

2. Position membrane so as to avoid the occurrence of any seams at drains.
 3. Seal off drain by running a hot trowel along the edge and firmly pressing against the rim.
- D. Install clamping ring and drain covers supplied with drain.
- E. Test all drains for proper flow and water tightness. Correct defects.

3.18 CORNER FLASHING

A. Inside Corner

1. Pre-cut all flashing pieces and prime all surfaces prior to installation.
2. Fabricate gusset 4-inch wide by 8-inch long with a 2-inch triangular tip.
 - a. Install gusset into corner using a torch and firmly pressing with a hot trowel.
 - b. Set gusset with triangular tip on base ply and wrapping the corner a minimum of 2-inches on each side.
3. Pre-cut base flashing membranes to provide a 4-inch tie-in to roof surface and 3-inch return at corner.
4. Mop first base flashing sheet into corner over gusset pressing overlap and tie-in firmly into position with a hot trowel.
5. Mop second base flashing sheet into position with edge tight into corner.
 - a. Cut off base tie-in selvage at 45-degree from vertical.
 - b. Seal all edges with a hot trowel.
6. Pre-cut top flashing membranes to provide a 6-inch tie-in to roof surface and 3-inch return at corner.
 - a. Remove aluminum facing where flashing overlap occurs.
7. Torch first top flashing sheet into corner over second base ply pressing overlap and tie-in firmly into position with a damp sponge.
 - a. Remove aluminum facing where flashing overlap occurs.
8. Torch second top flashing sheet into position with edge tight into corner.
 - a. Cut off base tie-in selvage at 45-degree from vertical.
 - b. Press flashing firmly into position with a damp sponge.

- c. Seal all edges with hot trowel and sprinkle granules to cover seeping asphalt.
- B. Outside Corners
 - 1. Pre-cut all flashing pieces and prime all surfaces prior to installation.
 - 2. Fabricate gusset 4-inch wide by 8-inch long with a 2-inch triangular tip.
 - a. Install gusset into corner using a torch and firmly pressing with a hot trowel.
 - b. Set gusset with triangular tip on base ply and wrapping the corner a minimum 2-inches on each side.
 - 3. Pre-cut base flashing membranes to provide a 4-inch tie-in to roof surface and 3-inch return at corner.
 - 4. Mop first base flashing sheet into corner over gusset pressing overlap and tie-in firmly into position with a hot trowel.
 - 5. Mop second base flashing sheet into position with returns wrapped around corners.
 - a. Cut off base tie-in selvage at 45-degree from vertical.
 - b. Seal all edges with a hot trowel.
 - 6. Pre-cut top flashing membranes to provide a 6-inch tie-in to roof surface and 3-inch return at corner.
 - a. Remove aluminum facing where flashing overlap occurs.
 - 7. Torch first top flashing sheet into corner over second base ply pressing overlap and tie-in firmly into position with a damp sponge.
 - a. Remove aluminum facing where flashing overlap occurs.
 - 8. Torch second top flashing sheet into position with edge tight into corner.
 - a. Cut off base tie-in selvage at 45-degree from vertical.
 - b. Press flashing firmly into position with a damp sponge.
 - c. Seal all edges with hot trowel.

3.19 CURBS

- A. Inspect and verify that all curbs are properly secured to deck, are level, a minimum 6-inches above finished roof, primed and ready to receive flashings.
- B. Base ply membrane is to run horizontally tight up against the vertical curb or cant as required.

1. When base ply membrane is to act as temporary seal for an extended length of time, carry membrane up vertical surface a minimum of 1-inch.
- C. Gusset to be fabricated 4-inch wide by 8-inch long with a 2-inch triangular tip.
 1. Install gusset onto corner using a torch and firmly pressing with a hot trowel.
 2. Set gusset with triangular tip on base ply and wrapping the corner a minimum 2-inches on each side.
- D. Install base ply flashing according to this section.
 1. Pre-cut flashing to the total sum of curb height, thickness plus 1-inch for inside curb securement and 4-inch tie-in along base with width to match that of curb plus 3-inch overlap on each end.
 2. Secure along inside of curb with roofing nails.
 3. Cut back corner base selvage at 45-degree angle from vertical.
- E. Install top ply as specified under this section.
 1. Pre-cut flashing to the total sum of curb height plus 6-inches for base tie-in with width to match that of curb plus 3-inch overlap at each end.
 2. Set granules with heated trowel on all surfaces to receive flashing.
 3. Cut flashing flush with the top of curb and seal edges with heated trowel.
 4. Cut back corner base selvage at 45-degree angle from vertical.
 5. Firmly press flashing into position using a damp sponge.
- F. Provide metal counter flashing.

3.20 ROOF EDGE

- A. Install base ply membrane as specified under this section. Carry membrane over roof edge a minimum of 3-inches and temporarily fasten using galvanized roofing nails.
- B. Install a continuous manufactured metal cleat (material) and edge metal system.
 1. Prime all dissimilar surfaces prior to membrane or flashing installation.
 2. Flange on edge to be 4-inch minimum.
 3. Nail flange to decking or wood blocking at 4-inch center - staggered.
- C. Cover edge with a reinforcing strip of base membrane mopped into place. Membrane is to carry beyond the metal flange onto base ply a minimum of 4-inches.

1. Hold the reinforcing strip back from outside edge of metal by 3/4-inch.
 2. Seal all edges with a hot trowel.
- D. Install top ply of membrane according to this section with the edge tight against the metal and sealed with a hot trowel.

3.21 COORDINATION AND SAFETY

- A. Readiness: Do not proceed with installation of roof insulation unless material, equipment, and tradesmen required for installation of roofing membrane over insulation are at project site and ready to install membrane immediately (same day) behind insulation work. Do not install more insulation each day than can be covered with waterproof membrane (and water cutoff) by end of that working day.
- B. Coordination: Coordinate roof installation with work specified in other sections which are in contact with roofing surface or affect performance of completed roofing system.
- C. Protection
1. Locate heated bitumen kettles on ground at safe distance and at least 10' from buildings and sidewalks. Provide at least one approved fire-extinguisher with minimum classification of 20 B: Within 30 ft. of each kettle during period that kettle is heated. Provide at least one additional 20 B: C classified extinguisher on roof near area being covered. Bitumen heating kettles shall be in good working order and complete with operational kettle lid. Dispense materials to reduce fire hazard.
 2. Where using torches or other flame producing devices for roofing applications, provide in immediate vicinity of work at least one approved fire-extinguisher or water hose connected to reliable adequate water supply. Protect combustible materials in close proximity to flame from ignition by shielding, wetting, or other approved means. In all cases, maintain fire watch in vicinity of operation for 2 hour after torches and flame producing devices have been extinguished.
 3. Provide barricades and, where necessary, signs to insure safety of general public and other workmen on job from fire and falling materials.

4. Provide temporary roof surface protection (use 2" thick plywood, wafer board or similar material) at work area where bitumen and roof materials are received on roof with at least 8' x 12' dimensions and adequate runway covering to eliminate excess drippage and to protect against wheeled traffic during disposal of surface dirt and debris and during installation of roofing system.

3.22 WORKMANSHIP

A. General

1. Roofing contractor is responsible for proper attachment of specified work to any work embedded in, in contract with, or forming integral part of specified roofing system.
2. Where no details are herein provided, apply built-up roofing and related work in accord with latest edition of Roofing Materials Manufacturer=s printed specifications.
3. Take special care to insure that bitumen is heated to proper temperature. Provide clearly visible and working thermometer on all kettles.
4. Accurately lay out all roof areas for proper sequence and lap of materials. Lay plies to chalk lines.
5. Thoroughly broom each ply in place while bitumen is hot and tacky to provide felts that are free from fishmouths, buckles, blisters, and other faulty workmanship.
6. Phased roof membrane practice will not be allowed. In one operation, finish application of built-up roofing membrane up to line of termination for end of each day's work.
7. At all roof edges and openings, furnish and install bleed sheets or make edge envelopes to prevent bitumen drippage.

3.23 RECOMMENDATIONS FOR CARE AND MAINTENANCE OF ROOF

- A. Roofing Contractor and Roofing Materials Manufacturer to furnish to Owner and Using Agency a copy of recommendations for care and maintenance of roofing and flashing. Include information on procedure to be followed in case of leaks or other problems and furnish telephone number and address of who to notify.

END OF SECTION

MODIFIED BITUMEN MEMBRANE ROOFING SYSTEM

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SECTION 07.620 FLASHING AND SHEET METAL

PART 1 GENERAL

1.01 SUMMARY

- A. The extent of each type of flashing and sheet metal work is indicated on the drawings and by provisions of this section.
- B. The types of work specified in this section include the following:
 - 1. Base Flashing and Counterflashing
 - 2. Thru-wall scuppers
 - 3. Termination bars
 - 4. Sill flashings
 - 5. Miscellaneous sheet metal accessories.
 - 6. Coatings and sealants as required for this application.
- C. Related Sections include the following:
 - 1. Division 4 Section "Unit Masonry" for copper thru-wall flashing and drip plates.
 - 2. Division 5 Section "Metal Fabrications" for downspout boots.
 - 3. Division 7 Section "Modified Bituminous Membrane Roofing"
 - 4. Division 7 Section "Prefabricated Coping System"
 - 5. Division 8 Section "Aluminum Entrances, Curtainwall and Storefronts"

1.02 SUBMITTALS

- A. Product data including product specifications, standard details, performance data, and general recommendations.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Store materials in a dry, protected, well-vented area. The contractor shall report damaged material immediately to the delivering carrier and note such damage on the carrier's freight bill of lading.
- B. Remove protective plastic surface film immediately after installation (if applicable).

1.04 PROJECT CONDITIONS

- A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of the work and protection of materials and finishes.

1.05 WARRANTY

A. Metal finish and watertightness warranty shall be provided in conjunction with Division 7 Section "Modified Bituminous Membrane Roofing". A full "roofing and metal" warranty is required.

PART 2 PRODUCTS

2.01 MATERIALS

A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.

- a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
- b. Thicknesses as indicated.

2. Color shall be selected by Architect from metal compatible with metal wall and roof panels.

B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; 2D (dull, cold rolled) finish.

C. Reglets

1. Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with interlocking counterflashing on exterior face, of same metal as reglet.

- a. Material: Pre-finished galvanized steel, minimum 22 gauge thick.

2. Provide "Springlok Flashing System" as manufactured by Fry Reglet where indicated on Drawings.

D. All roof edge metal shall be manufactured system from the roof manufacturer and be included in the full roof warranty.

2.02 ACCESSORIES

A. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.

- B. Fasteners: Same metal as flashing/sheet metal or, other noncorrosive metal as recommended by sheet manufacturer.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.03 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
 - 1. Obtain field measurements for accurate fit before shop fabrication.
 - 2. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- C. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- E. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant

unless otherwise recommended by sealant manufacturer for intended use.

2.04 SHEET METAL FABRICATIONS

- A. Base Flashing: Pre-finished galvanized steel: 20 gauge thick.
- B. Counterflashing and Flashing Receivers: Pre-finished galvanized steel: 22 gauge thick.
- C. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, minimum 4-inch wide wall flanges to interior, and base extending minimum 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:
 - 1. Stainless steel with fully welded seams: 24 gauge thick.
 - 2. Around entire perimeter of scupper, provide "polyurethane coating system (Soprema Alsan Flashing System)".
- D. Sill flashings: Stainless Steel: 24 gauge thick.
- E. Miscellaneous Flashing: Stainless Steel: 24 gauge thick.
- F. One piece subsills for curtainwall window units to be prefinished aluminum - 0.050 gauge. Fabricate as indicated on the drawings.

2.05 EAVE METAL/FASCIA

- A. Metal for eaves and fascia shall be same material and gauge as the roof panels with .050 aluminum clips.

2.06 GUTTERS AND DOWNSPOUTS

- A. Gutters and downspouts shall be fabricated from the same material as the roof panels. Gutters and downspouts shall be sized and shaped as indicated on the drawings. Gutter color shall match roof panel color; and downspout color shall match wall panel color.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement so that completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight. Use fasteners, solder, welding rods,

protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 5. Install sealant tape where indicated.
 6. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints as shown and as required for watertight construction.

3.02 INSTALLATION

- A. General: Install sheet metal roof drainage items and flashing to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system. Provide

concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

- B. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant.
- C. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - 1. After installation of metal and membrane, cover entire area (bottom, sides, and top) with "polyurethane coating system" where connection to modified roofing system occurs as specified in Division 7 Section "Modified Bituminous Membrane Roofing".
- D. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch long, but not exceeding 12-foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch high, end dams where flashing is discontinuous.
- E. Sill Flashings: Fabricate sill and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch high, end dams.
- F. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
 - 1. After installation of pipe or post counterflashing, install "polyurethane coating system" as specified in Division 7 Section "Modified Bituminous Membrane Roofing".
- G. Downspouts shall be installed true and plumb. Downspouts shall be securely anchored to the building and shall tie into the underground drainage system.

3.03 CLEANING

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed

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unless otherwise indicated in manufacturers written installation instructions.

B. Clean exposed metal surfaces, removing substances which might cause corrosion of metal.

3.04 PROTECTION

A. Protection: Installer shall advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction, to ensure that work will be without damage or deterioration, other than natural weathering, at time of substantial completion.

END OF SECTION

SECTION 07.717 PREFABRICATED COPING SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Work included: Furnishing and installing factory fabricated and finished coping systems.
- B. Related Sections include the following:
 - 1. Division 7 Section "Modified Bituminous Membrane Roofing"
 - 2. Division 7 Section "Flashing and Sheet Metal"

1.02 REFERENCES

- A. Factory Mutual Research Corporation (FMRC), P.O. Box 9102, Norwood, MA 02082, 617-762-4300.
- B. SPRI Sheet Membrane and Component Suppliers to the Commercial Roofing Industry, 175 Highland Ave., Needham, MA 02194, 617-444-0242, fax: 617-444-6111.

1.03 DESIGN REQUIREMENTS

- A. Thermal movement:
 - 1. Completed system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.
- B. Capacities for gauge, span or loading other than those tested may be determined by interpolation of test results within the range of test data.

1.04 SUBMITTALS

- A. Product data: Indicate product description, finishes and installation instructions, including interface with adjacent materials and surfaces.
- B. Shop drawings: Indicate material types, sizes, shapes, thicknesses, Finishes, fabrication details, splice plate locations and details, anchors, connections, and relation to adjacent work. Draw details and profiles at appropriate scale. **Details must be project specific** - manufacturer's or NRCA "standard" details will not be acceptable.
- C. Samples: Submit as follows:
 - 1. Finish: metal samples for architect's color and finish verification.

2. Manufactured components, 1'-0" length in style and finish specified, including flashing, cant, anchor plate and splice plate assembly.
- D. Intent to warrant: Submit an intent to warrant executed by authorized representative of system manufacturer, indicating that manufacturer has reviewed drawings, specifications, and conditions affecting the work, and proposes to provide warranties as referenced herein without further stipulation.

1.05 QUALITY ASSURANCE

- A. High performance coping shall be **certified** by the coping manufacturer to meet performance design criteria according to the following test standards:
1. ANSI/SPRI ES-1 Test RE-3 for Coping: The coping system shall be tested simultaneously on horizontal and vertical surfaces and shall exceed horizontal and vertical design wind pressure as calculated in accord with the ANSI/SPRI ES-1 Test RE-3. Use the current edition of ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
 2. The coping product shall be UL Classified by Underwriters Laboratories, Inc. or other 3rd party verification of compliance with the ANSI/SPRI ES-1 Wind Design Standard.
- B. **CONTRACTOR'S OPTION**: if contractor is on the National Roofing Contractors Association's "Authorized Fabricator" listing, submit proof of listing during submittal phase for approval. Each shop fabricated piece shall be marked with NRCA ANSI/SPRI ES-1 approved adhered label. **Full adherence to these specifications and the Drawings is required and governs over any NRCA standards.**

1.06 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be delivered in the manufacturer/supplier's original sealed, labeled containers.
- B. Store materials in a dry, protected, well-vented area. Report damaged material immediately to delivering carrier and manufacturer/supplier.

1.07 WARRANTY

- A. Refer to Division 7 Section "Modified Bituminous Membrane Roofing" for specific information regarding roof and metal warranty required.
- B. Provide installers warranty warranting system to be free of defects in materials and workmanship and to be installed in strict accordance with manufacturer's shop drawings and/or installation instructions. **Warranty period shall be a minimum of five years.**
- C. Provide manufacturer's warranty warranting system to be free of defects in materials and workmanship, to resist blow-off and to be leak tight, due to conditions within stated design limits. Provide warranty based on certified testing for design and performance criteria specified herein. **Warranty period shall be twenty years.**
- D. Provide manufacturer's warranty warranting fluoropolymer coating to remain free, from peeling, checking or cracking (except for slight crazing as may occur on tightly roll-formed edges or brake bends at time of forming pre-painted sheet), chalking in excess of numerical rating of 8 when measured in accordance with ASTM D659-86, or fading in excess of 5 N.B.S. units during warranty period. **Warranty period shall be twenty years.**

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Imetco (Innovative Metals Company)
- B. W.P. Hickman Company
- C. Metal-Era

2.02 MANUFACTURED COPINGS

- A. Provide Imetco Performa Edge Coping or equal from one of the approved manufacturers listed.
- B. Characteristics:
 - 1. Coping material: Aluminum
 - 2. Coping finish: Fluoropolymer coating, as specified herein.
 - 3. Wall, face and back leg dimensions: As indicated on the drawings; if not indicated, minimum length to extend beyond base of blocking by a minimum of 1".
 - 4. Coping length: 12'-0" minimum.
 - 5. Coping joints: Splice plates, concealed, in accordance with manufacturer's product data.

6. Coping anchor plate: Minimum 20 GA galvanized steel. Actual thickness may be determined by the manufacturer to comply with specified performance.
7. Prefabricated sections: Factory assembled, continuously welded, mitered corners, and any other continuously welded transitions shall be factory fabricated and post-finished in fluoropolymer finish to match coping.
 - a. If Contractor is an "Authorized Fabricator", this requirement still applies. If this cannot be achieved in-house, provide from one of the approved manufacturers.

C. Accessories

1. Splice plates: Manufacturer's recommended thickness, minimum 6" width, with front and rear legs and with extruded butyl sealant tape for concealed installation. Finish shall match coping.
2. Anchor plate: Minimum 20 GA galvanized steel of manufacturers tested and approved standard design.
 - a. Molded plastic or polystyrene shall not be acceptable.

2.03 ACCESSORIES

1. Nailers: Preservative-treated wood as specified in Division 6 Section "Rough Carpentry"; sizes and profiles as indicated.
2. Stainless Steel Fasteners: provide in sizes as recommended by the manufacturer per substrate application in fastening pattern provided.
 - a. **No exposed fasteners permitted.**
 - b. Structural adhesive may not be used without mechanical fastening devices.

2.04 FABRICATION

- A. Prefabricate system in manufacturer's factory to greatest extent possible.
- B. Miter and weld joints in tops and faces of coping corners and transitions. Perform welding prior to final finish. Factory bend fascia corners to specific job requirements.

2.05 FINISHES

A. Fluoropolymer coating finish:

1. Two-coat factory applied, baked on Kynar 500 fluoropolymer coating system, AAMA 2604
2. Coating system shall provide minimum 1.0 mil dry film thickness consisting of minimum 0.20 mil primer and minimum 0.80 mil color coat.
 - a. Color shall be selected from manufacturer's full line.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that other trades are complete before installing fascia and coping system.
- B. Mounting surfaces to be straight, secure; substrates of proper width.
- C. Contractor to verify that coping installation will not disrupt other trades. Verify that substrate is dry, smooth, level, clean and free of foreign matter. Correct defects before proceeding.
- D. Contractor shall inspect conditions. By the starting of their work, the contractor approves and accepts the existing conditions are suitable for the installation of their work.

3.02 PREPARATION

- A. Isolate treated wood nailer from galvanized cleats with moisture proof membrane.
- B. Refer to construction documents, shop drawings and coping installation instructions.
 1. Coordinate installation with membrane manufacturer/supplier's instructions before starting.
- C. Wood blocking must be well secured to the parapet wall and installed in a fashion that is straight and level. Furnish mechanical fasteners consistent with manufacturer/supplier's instructions; suitable for parapet substrates and in accordance with ANSI/SPRI ES-1-03 requirements.

3.03 INSTALLATION

A. Coping

1. Install coping system in accordance with manufacturer's product data and approved shop drawings, to achieve wind uplift classification.

2. Install anchor plates with concealed fasteners at 3'-0" o.c. maximum. Install concealed splice plates at joints in accordance with manufacturer's product data.
 - a. Fasteners attaching the continuous cleat to the wood blocking shall not be over tightened to restrict the continuous cleat from moving freely.
3. Snap copings into place over anchor plates and splice plates with minimum 3/4" wide space over splice plate. Set coping over splice plate with extruded butyl sealant tape, 1/2" from joint edge.
No exposed fasteners are permitted.
4. Make weathertight fit, allowing for expansion and contraction as recommended by manufacturer's product data.

END OF SECTION

SECTION 07.840 FIRESTOPPING

PART 1 GENERAL

1.01 SUMMARY

- A. Only tested firestop systems shall be used in specific locations as follows:
1. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions).
 2. Openings between structurally separate sections of wall.
 3. Gaps between the top of walls and ceilings or roof assemblies.
 4. Openings and penetrations in fire-rated partitions or walls containing fire doors.
 5. Openings around structural members which penetrate fire rated walls.
- B. Related Sections include the following:
1. Division 7 Section "Joint Sealants" for sealant for non-fire rated and non-smoke barrier partitions.

1.02 REFERENCES

- A. Test Requirements: ASTM E-814, "Standard Method of Fire Tests of Through Penetration Fire Stops" (July 1997).
- B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
1. UL Fire Resistance Directory:
 - a. Firestop Devices (XHJI)
 - b. Fire Resistance Ratings (BXUV)
 - c. Through-Penetration Firestop Systems (XHEZ)
 - d. Fill, Voids, or Cavity Material (XHHW)
 - e. Forming Materials (XHKU)
- C. Test Requirements: UL 2079, "Tests for Fire Resistance of Building Joint Systems" (July 1998.)
- D. Inspection Requirements: ASTM E 2174 - 01, "Standard Practice for On-site Inspection of Installed Fire Stops."
- E. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments
- F. ASTM E-84, Standard Test Method for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

- A. Product Literature: Submit product data sheets and the manufacturer's installation instructions.
1. Include Safety Data Sheets.

1.04 QUALITY ASSURANCE

- A. Products used for firestopping shall be asbestos free materials classified by Underwriters Laboratories, Inc. as Fill, Void or Cavity Material for Through-Penetration Firestop Systems.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in manufacturer's original unopened container, clearly identifying each product specified, relating it to the product literature submitted.
- B. Store in accordance with manufacturer's recommendation, with proper precautions concerning shelf life, temperature, humidity, and similar storage factors to ensure the fitness of the material when installed.

PART 2 PRODUCTS

2.01 GENERAL

- A. Provide firestopping composed of components that are compatible with each other and substrates forming joints under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

2.02 MANUFACTURERS

- A. Hilti, Inc.
- B. 3M Fire Protection Products
- C. Tremco Incorporated

2.03 MATERIALS

- A. Use only firestop products that have been UL 1479, ASTM E-814, or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space

requirements, and fire-rating involved for each separate instance.

2.04 VOC CONTENT

- A. Provide fire-resistive joint systems that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
1. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
 2. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
 3. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
 4. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

- A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.
- B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.03 INSTALLATION

- A. Install firestop materials in accordance with UL Fire Resistance Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of

through-penetration and construction joint materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
3. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

- A. Examine sealed joints to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Perform under this Section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.05 CLEANING

- A. Remove and recycle excess material, droppings and debris.
 1. Close and seal tightly all partly used sealant containers and store protected in well-ventilated, fire-safe area at moderate temperature.
 2. Place used sealant containers in areas designated for hazardous materials.
- B. Remove sealant from materials and surfaces not specifically required to be sealed.

3.06 PROTECTION

- A. Protect applied firestopping from damage.

END OF SECTION

SECTION 07.920 JOINT SEALANTS

PART 1 GENERAL

1.01 SUMMARY

- A. The extent of each form and type of joint sealer is indicated on drawings and by provisions of this section.
- B. The applications for joint sealers as work of this section include the following:
 - 1. Wall control joints in non-fire rated walls.
 - 2. Joints between metal door and window frames and adjacent construction.
 - 3. Acoustical sealant
 - 4. At locations where dissimilar metals come together.
 - 5. Concrete / masonry expansion joints
 - 6. Other locations indicated or required to properly seal buildings.
- C. Related Sections include the following:
 - 1. Division 7 Section "Firestopping" for sealant for fire rated partitions

1.02 SUBMITTALS

- A. Product Literature
 - 1. Submit product data sheets and the manufacturer's installation instructions. If two or more different sealants are to be in physical contact with each other, obtain from each manufacturer confirmation that its product is compatible with the proposed and adjacent products, including any other products which may be used by other sub-contractors. Include primer literature with the submittal document unless the manufacturer's sealant submittal specifically eliminates the need for a primer.
 - 2. If a stain type primer is required for the sealant selected, such information shall be specifically included on submittal documents calling attention to the need for such staining type primer and noting the planned precautions to prevent exposed stain residue.
 - 3. Include Safety Data Sheets for sealants.
- B. Color Samples: Submit manufacturer's standard color chart. Submit cured samples of each chosen color for verification of actual color to be installed. Multiple cured samples may be required for selection.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Deliver in manufacturer's original unopened container, clearly identifying each product specified, relating it to the product literature submitted.
- B. Store in accordance with manufacturer's recommendation, with proper precautions concerning shelf life, temperature, humidity, and similar storage factors to ensure the fitness of the material when installed.

1.04 PROJECT CONDITIONS

- A. Weather Conditions - Do not proceed with installation of liquid sealants under unfavorable weather conditions. Install elastomeric sealants when temperature is in lower third of temperature range recommended by manufacturer for installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. General Sealer Performance Requirements

- 1. Provide colors indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors. Select materials for compatibility with joint surfaces and other indicated exposures, and except as otherwise indicated, select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicated.

B. Exterior General Use and all exterior vertical wall joints:

- 1. Neutral Cure Silicone sealant conforming to ASTM C920, Type S, Class 50, Grade NS.

C. Exterior Concealed Joints and Under Thresholds: Silicone metal caulk; ASTM C920

D. Exterior Concealed Joints between two assembled rigid surfaces in compression: Polyisobutylene sealant tape conforming to AAMA 804.1

E. Exterior and Interior Horizontal Joints subject to pedestrian traffic:

- 1. Two-part polyurethane conforming to ASTM C920, Class 25, Type M; self-leveling, zero-VOC.

F. Interior Non-wet Areas: One-component acrylic latex water-based sealant conforming to ASTM C834, VOC content: maximum 42 grams/liter.

- G. Interior Wet Areas: One-part, mildew-resistant silicone rubber conforming to ASTM C920, Type S, Class 25, Grade NS.
- H. Sealant Backer Rod: Compressible rod-stock polyethylene foam, polyethylene-jacketed polyurethane foam, butyl-rubber foam, neoprene foam, or other flexible, permanent, durable, nonabsorptive material as recommended for compatibility with sealant by sealant manufacturer.
- I. Joint Cleaner, Primer, and Bond Breaker: As recommended by sealant manufacturer.
- J. Fiber Expansion Joint Material: Preformed cellular fiber complying with ASTM D1751.
- K. Acoustical Sealant: Nonskinning, nonhardening, permanently flexible sealant specifically designed for sealing gypsum wallboard.
- L. Foam Sealants: Blown with hydrocarbon or HFC-134a.

PART 3 EXECUTION

3.01 PRECONSTRUCTION FIELD-ADHESION TESTING

- A. Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

3.02 EXAMINATION

- A. Inspect substrate surface to assure that no bond breaker materials contaminate the surface to which the sealant is to adhere and to ensure that unsound substrates are repaired. Installation of sealant shall be evidence of acceptance of the substrate.
- B. Verify joint dimensions prior to installation of the sealant to ensure that all dimensions are within tolerance established in the manufacturer's literature. Unacceptable variations shall be called to the Architects attention for resolution prior to installing any material.

3.03 PREPARATION

- A. Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances which could interfere with bond of sealant or caulking compound. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer.

- B. Prime or seal joint surfaces where indicated, and where not indicated if recommended by sealant manufacturer, prior to installation of any backer rod or bond breaker tape. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

3.04 INSTALLATION

- A. General: Comply with manufacturer's printed instructions, except where more stringent requirements are shown or specified, and except where manufacturer's technical representative directs otherwise.
- B. Set joint filler units full depth of joint or position in joint to coordinate with other work, including installation of backer rods and sealants. Do not leave voids or gaps between ends of joint filler units.
- C. Install sealant backer rod for liquid elastomeric sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for application indicated in which case a bond breaker tape shall be used to prevent 3 sided adhesion. Apply backer rod using blunt or rounded tools which will ensure a uniform depth without puncturing the material. Use a rod oversized a minimum of 33% for closed cell and 50% for open cell, unless otherwise required by the manufacturer.
- D. Employ only proven installation techniques, which will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces, with a smooth, even finish.
- E. Install sealant to depths as shown or, if not shown, as recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of bead.
 - 1. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.
 - 2. For joints sealed with non-elastomeric sealants, fill joints to a depth in range of 75% to 125% of joint width.
- F. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces or to

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migrate into voids of adjoining surfaces. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

- G. Curing: Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.

3.05 CLEANING

- A. Remove and recycle all excess material.
 - 1. Close and seal tightly all partly used sealant containers and store protected in well-ventilated, fire safe area at moderate temperature.
 - 2. Place used sealant tubes and containers in areas designated for hazardous materials.

END OF SECTION

SECTION 07.950 EXPANSION CONTROL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Architectural joint systems for building interiors.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete"

2. Division 9 Section "Gypsum Board Assemblies"

1.03 DEFINITIONS

A. Maximum Joint Width: Widest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

B. Minimum Joint Width: Narrowest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

C. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint.

D. Nominal Joint Width: The width of the linear opening specified in practice and in which the joint system is installed.

1.04 SUBMITTALS

A. Shop Drawings: Provide the following for each joint system specified and obtain approval prior to fabrication and shipment of materials to the job site:

1. Placement Drawings: Include line diagrams showing plans, elevations, sections, details, splices, blackout requirement, entire route of each joint system, and attachments to other work. Where joint systems change planes, provide isometric or

clearly detailed drawing depicting how components interconnect.

- B. Product Data: Submit copies of manufacturer's latest published literature for materials specified herein for approval, and obtain approval before materials are fabricated and delivered to the site. Data to clearly indicate movement capability of cover assemblies and suitability of material used in exterior seal for UV exposure.
- C. Samples for Initial Selection: For each type of joint system indicated.
 - 1. Include manufacturer's color charts showing the standard range of colors and finishes available for each exposed metal and elastomeric seal material.
- D. Certificates - Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-rated expansion joint assemblies with requirements indicated.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Approved by manufacturer.
- B. Source Limitations: Obtain all architectural joint systems through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of architectural joint systems and are based on the specific systems indicated. Refer to Division 01 Section "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- D. Loading Characteristics: Standard loading refers to covers that are capable of withstanding up to 500 lb. point loads. Heavy duty refers to covers that are capable of withstanding up to 2000 lb. point loads.
- E. Fire-Test-Response Characteristics: Where indicated, provide architectural joint system and fire-barrier assemblies identical to those of assemblies tested for fire resistance per UL 2079 and/or ASTM E 1966 by a testing and inspecting agency

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acceptable to authorities having jurisdiction. Fire rating not less than the rating of adjacent construction.

- F. Manufacturer to provide 5 year warranty for all joint covers.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aluminum: ASTM B 221, Alloy 6005A-T61, 6063-T5, 6061-T5, 6105-T5 for extrusions; ASTM B 209, Alloy 6061-T6, 3003-H14, 5005-H34 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
2. Mill Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
3. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
4. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.
5. High-Performance Organic Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturers' written instructions.

B. Stainless Steel: ASTM A 666, Type 304 for plates, sheet, and strips.

1. Finish: No.4, directional satin.

- a. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- C. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.
- D. Compression Seals: ASTM D2000; preformed rectangular elastomeric extrusions having internal baffle system and designed to function under compression.
- E. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required rating period.
- F. Moisture Barrier: 7-ply laminate reinforced Polyethylene.
- G. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.02 ARCHITECTURAL JOINT SYSTEMS, GENERAL

- A. General: Provide architectural joint systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
- B. Design architectural joint systems for the following size and movement characteristics:
 - 1. Nominal Joint Width: As indicated on Drawings.
 - 2. Maximum Joint Width: As indicated on Drawings.
 - 3. Minimum Joint Width: As indicated on Drawings.
 - 4. Lateral Shear Movement Capability: As indicated on Drawings.

2.03 ARCHITECTURAL JOINT SYSTEMS FOR BUILDING INTERIORS

- A. Construction Specialties, Inc., 6696 Route 405 Highway, Muncy, PA, shall manufacture expansion joint cover assemblies specified herein and indicated on the drawings. Other manufacturers may be accepted if the manufacturer can demonstrate product compliance with the requirements of the contract documents. Substitution requests must be reviewed

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prior to bid and must include the following information:

1. Details
 2. ASTM- E1399 test reports
 3. Mock-ups
 4. Reference list of projects with similar products as those specified herein.
 5. Sample of written 5 year warranty
- B. Floor-to-Floor Joint Systems
1. Basis-of-Design Product: Construction Specialties, Inc. model GFPS-100
 2. Type: Cover plate. Flush floor cover.
 - a. Exposed Metal: Aluminum.
 - 1) Finish: Mill.
 3. Cover Plate Design: Plain
 4. Attachment Method: Mechanical anchors.
 5. Load Capacity: Standard duty.
 6. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.
 7. Moisture Barrier: Manufacturer's standard.
- C. Flush Gasketed Wall and Ceiling Cover
1. Basis-of-Design Product: Construction Specialties, Inc. model FWFC-100
 2. Type: Cover plate.
 - a. Exposed Metal: Aluminum.
 - 1) Finish: Mill.
 3. Cover Plate Design: Plain
 4. Attachment Method: Mechanical anchors.
 5. Load Capacity: Standard duty.
 6. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.
 7. Moisture Barrier: Manufacturer's standard.

2.04 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

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PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine surfaces and blockouts where architectural joint systems will be installed for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare substrates according to architectural joint system manufacturer's written instructions.
- B. Repair concrete slabs and blockouts using manufacturer's recommended repair grout of compressive strength adequate for anticipated structural loadings.
- C. Coordinate and furnish anchorages, setting drawings, and instructions for installing joint systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.
- D. Cast-In Frames: Coordinate and furnish frames to be cast into concrete.

3.03 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing architectural joint assemblies and materials unless more stringent requirements are indicated.
- B. Metal Frames: Perform cutting, drilling, and fitting required to install joint systems.
 - 1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - 2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper joint installation and performance.
 - 3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 - 4. Locate in continuous contact with adjacent surfaces.

5. Standard-Duty Systems: Shim to level where required. Support underside of frames continuously to prevent vertical deflection when in service.
 6. Heavy-Duty Systems: Repair or grout blockout as required for continuous frame support and to bring frame to proper level. Shimming is not allowed.
 7. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.
- C. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
1. Provide in continuous lengths for straight sections.
 2. Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
 3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- D. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer before installing compression seals.
- E. Terminate exposed ends of joint assemblies with field- or factory-fabricated termination devices.
- F. Fire-Resistance-Rated Assemblies: Coordinate installation of architectural joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.
1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
- G. Water Barrier: Provide water barrier at exterior joints and where called for on Drawings. Provide drainage fittings where indicated.

3.04 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

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- B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over joints. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION

SECTION 08.110 STEEL DOORS AND FRAMES

PART 1 GENERAL

1.01 SUMMARY

- A. Extent of metal doors and frames is shown and scheduled on drawings and includes the following:
 - 1. Hollow metal doors and frames, shop finished
- B. Related Sections include the following:
 - 1. Division 7 Section "Joint Sealants"
 - 2. Division 8 Section "Flush Wood Doors"
 - 3. Division 8 Section "Glazing"
 - 4. Division 8 Section "Door Hardware"
 - 5. Division 9 Section "Painting"

1.02 SUBMITTALS

- A. Shop Drawings - Submit for fabrication and installation of hollow metal frames. Include details of construction, location and installation requirements of finish hardware and reinforcements and details of joints and connections. Show anchorage and accessory items.
 - 1. Provide schedule of doors and frames using same reference numbers for details and openings as those on Drawings.

1.03 QUALITY ASSURANCE

- A. Provide hollow metal frames complying with ANSI A250.8/SDI100-1998 Recommended Specifications for Standard Steel Doors and Frames and as herein specified.
- B. Manufacturer -Provide each type of door frame unit by a single firm specializing in production of that type of work.
- C. Fire-rated Assemblies: Provide fire-rated units investigated and tested in accordance with ASTM E152 as fire door assemblies, complete with type of hardware to be used. Identify each fire door and frame with recognized testing laboratory labels, indicating applicable fire rating. Construct and install assemblies to comply with NFPA Standard No. 80, and as herein specified.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work carton or crated to provide protection during transit and job storage.

- B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired, provided finish items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on wood sills at least 4" high, or otherwise store on floors in manner that will prevent rust and damage. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Curries Company
- B. Ceco Door Products
- C. Steelcraft Manufacturing Company

2.02 MATERIALS

- A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A569 and ASTM A568.
- B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A366 and ASTM A568.
- C. Galvanized Steel Sheets: Zinc coated carbon steel sheets of commercial quality complying with ASTM A653, with A90 coating.
- D. Inserts, Anchors Bolts and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A153 Class C or D as applicable.

2.03 COMPONENTS

- A. Steel Doors
 - 1. Provide flush metal doors indicated on drawings or schedules, complying with requirements for SDI Level II, Model 2 (16 gauge, heavy duty, seamless).
 - 2. **All exterior doors shall be galvanized.** All other metal items in exterior doors shall also be galvanized.
 - 3. Doors scheduled to have label shall comply with requirements of subparagraph "Fire-rated Assemblies."
 - 4. Close top and bottom edges as integral part of door construction or by addition of inverted steel channels.

5. Exterior doors shall be insulated with fiberglass insulation (minimum density 0.8 lbs per cubic foot).
- B. Standard Steel Frames
1. Provide 14 gauge metal frames (unless otherwise noted on Drawings or as specified herein) for doors, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames with mitered and full welded corners, unless otherwise indicated.
 - a. Provide 14 gauge metal frames at all frames supporting hollow metal doors.
 - b. All exterior frames and other frames supporting galvanized doors shall be galvanized.
 2. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single door frames and 2 silencers on heads of pair of door frames.
 3. Plaster Guards: Provide 26 gage steel plaster guards or mortar boxes, welded to frame, at back of finish hardware cutouts where mortar or other material might obstruct hardware operation.
 4. Provide floor anchors at each jamb and mullion in addition to required wall anchors.
 5. Provide labeled frames for fire rated openings.
 - a. Fire openings as required are indicated on the Drawings.

2.04 FABRICATION

A. General

1. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at project site.
2. Fabricate exposed faces of doors and panels, including stiles and rails of non-flush units, from only cold-rolled steel.
3. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold-rolled or hot-rolled steel (at fabricator's option). All items in exterior doors to be galvanized.

4. Fabricate doors indicated to be galvanized from galvanized sheet steel. Close top and bottom edges as integral part of door construction or by addition of inverted galvanized steel channels.
 5. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.
- B. Finish Hardware Preparation
1. Prepare doors and frames to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 series specifications for door and frame preparation for hardware.
 2. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site. Furnish closer reinforcing whether closer furnished or not. Hinge Reinforcement: Provide door frame with three 4-1/2"x4-1/2"x7" gauge minimum, steel hinge reinforcement. Additional spot welds to the door frames factory spot welds are to be added prior to installation as well as, touching the welds with primer.
 3. Locate finish hardware as shown on final shop drawings or, if not shown, in accordance with "Recommended Locations for Builder's Hardware", published by Door and Hardware Institute.

2.05 FINISHES

A. Shop Paint

1. Clean, treat and paint exposed surfaces of steel door and frame units.
2. Clean steel surfaces of mill scale, rust, oil, grease, dirt and other foreign materials before application of paint.
3. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.
4. Prior to application of ANY hardware, finish coat shall be SHOP applied (frames may be field applied), primed with 2 coats of finish paint in accordance with Division 9 Section "Painting". Hardware and doors are not to be installed until ALL painting has been completed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Installer must examine substrate and conditions under which steel doors and frames are to be installed and must notify Contractor in writing of any conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.02 INSTALLATION

A. General

1. Install standard steel doors, frames, and accessories in accordance with final shop drawings and manufacturer's data, and as herein specified

B. Placing Frames

1. Comply with provisions of SDI-105 "Recommended Erection Instructions for Steel Frames", unless otherwise indicated.

2. Place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned and braced securely until permanent anchors are set. After wall construction is completed remove temporary braces and spreaders leaving surfaces smooth and undamaged.

3. Locate 3 wall anchors, of type suitable for construction involved, per jamb at hinge and strike levels and floor anchor at each jamb and mullion.

C. Door Installation

1. Fit metal doors accurately in frames, within clearances specified in SDI-100-98.

2. Place fire-rated doors in clearances as specified in NFPA Standard No. 80.

3.03 ADJUSTING

A. Final Adjustments: Check and readjust operation of finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION

STEEL DOORS AND FRAMES

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SECTION 08.211 FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SUMMARY

- A. Extent and location of each type of wood door is shown on Drawings and in schedule.
- B. Types of doors required include the following:
 - 1. Pre-finished solid core flush wood doors with veneer faces.
- C. Contractor to furnish one quart of each factory finish selected as part of door package. This finish is for field application / repair of damaged or field modified doors and shall be delivered to the site with the doors.
- D. Related Sections include the following:
 - 1. Division 8 Section "Steel Doors and Frames"
 - 2. Division 8 Section "Door Hardware"
 - 3. Division 8 Section "Glazing"

1.02 SUBMITTALS

- A. Product Data: Submit door manufacturer's product data, specifications and installation instructions for each type of wood door. Include details of core and edge construction, trim for openings and louvers (if any) and similar components.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicated blocking locations for hardware locations.
 - 2. Indicate dimensions and locations of mortises and holes for hardware.
 - 3. Indicate dimensions and locations of cutouts.
 - 4. Indicate fire-protection ratings for fire-rated doors.
 - 5. Requirements for veneer matching.
 - 6. Doors to be factory finished and finish requirements.
- C. Product Warranty: Provide manufacturer's standard extended warranty for review.

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- 1.03 QUALITY ASSURANCE
- A. General: Comply with requirements of the following standards unless otherwise indicated.
1. WDMA I.S.1-A-11, "Architectural Wood Flush Doors."
 2. Fire-Rated Wood Doors: Where fire-resistance classifications are shown or scheduled for wood door assemblies, provide doors which comply with requirements of NFPA No. 80 "Standard for Fire Doors and Windows" and which have been tested and rated with single point hardware. Provide label of an approved nationally recognized independent testing laboratory on each door.
- B. Allowable Tolerances for Fabrication:
1. Size, overall dimensions $-1/16"$
 2. Maximum warp and diagonal squareness $-1/8"$
- 1.04 DELIVERY, STORAGE AND HANDLING
- A. Protect wood doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with the "On-site Care" recommendations of NWMA pamphlet "Care and Finishing of Wood Doors" and with manufacturer's instructions.
- B. Deliver doors to site ONLY after building has reached average prevailing humidity of this area. Refer to Project Conditions as specified herein.
- C. Store doors in area where no excessive variations of heat, dryness or humidity are to be encountered.
- 1.05 PROJECT/SITE CONDITIONS
- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.
- 1.06 WARRANTY
- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:

- a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Graham Manufacturing Corp.
- B. Marshfield Door Systems
- C. Algoma Hardwoods

2.02 DOOR CONSTRUCTION, GENERAL

- A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
- B. WDMA I.S.1-A-11 Performance Grade: Extra heavy duty.
 1. All doors must meet specified WDMA Performance Duty Level, including face screw holding requirement. Surface applied hardware shall be installed with screws; through bolts are not acceptable.
- C. Particleboard-Core Doors
 1. Particleboard: ANSI A208.1, Grade LD-2 only, made with binder containing no urea-formaldehyde resin.
 2. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices and other screw applied hardware.
- D. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 1. Mineral-Core Doors
 - a. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 - b. Blocking: Provide blocking with screw-holding capability approved for use in doors of fire-

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protection ratings indicated to eliminate through-bolting hardware.

(1) Indicate blocking locations on shop drawings.

- c. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.03 INTERIOR SOLID CORE DOORS

- A. Grade: Custom, with Grade A faces.
- B. Species: cherry, select red
- C. Cut: plain sliced
- D. Match between Veneer Leaves: Book match.
- E. Assembly of Veneer Leaves on Door Faces: running match.
- F. Pair and Set Match: Provide for doors hung in same opening.
- G. Core: Particleboard or mineral core (based on fire requirements)
- H. Exposed Vertical Edges: Hardwood, of same or compatible species as face, minimum thickness of 1/2 inch.
- I. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.

2.04 ACCESSORIES

- A. Glazing
 - 1. Factory install glass in fire rated doors only.
 - a. Per NFPA 80, 2010 Edition, fire rated doors shall have glass installed by door manufacturer or in licensed shop under label listing service.
 - 2. Refer to Division 8 Section "Glazing" for glass view panels in flush wood doors. Fill glazing bead nail holes in factory finished doors.
- B. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard flush wood beads unless otherwise indicated.
 - 1. Wood Species: Same species as door faces.
 - 2. Profile: to be selected by Architect from manufacturer's full line.

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3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips as required and approved for such use.
- C. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
 1. Profile to be selected by Architect from manufacturer's full line.

2.05 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 1. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Factory cut and trim openings through doors.
 1. Light Openings: Trim openings with moldings of material and profile selected.
 2. Glazing: Factory install glazing in fire rated doors. Comply with applicable requirements in Division 8 Section "Glazing."
 3. Louvers: Factory install louvers in prepared openings.

2.06 FINISHES

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including

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fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted at edges of cutouts, and mortises.

B. Transparent Finish

1. Grade: Custom
2. Finish: Manufacturer's standard UV cured polyurethane, equal to WDMA TR6 catalyzed polyurethane.
3. Staining: As selected by Architect from manufacturer's full range.
 - a. Final color, build, and sheen to be approved by architect based on actual review samples.
4. Factory pre-finished doors to be individually protected with transparent poly-wrap at the factory.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs. Any deficiencies must be corrected prior to door installation.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Condition doors to average prevailing humidity in installation area prior to hanging. Building shall be fully enclosed and permanent climate control system operating.
- B. Hardware: Coordinate installation with Division 8 Section "Door Hardware".
- C. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
1. Install fire-rated doors according to NFPA 80.
 2. Install smoke control doors according to NFPA 105.

- D. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
 - 3. Trim bottom rail only to extent permitted by labeling agency.
- E. Factory-Finished Doors: Do not trim factory finished doors for width.

3.03 ADJUST AND CLEAN

- A. Operation: Correct any deficiency that prohibits the door from swinging or operating freely. Do not remove hinge screws after initial insertion. Shims used for alignment purposes must be inserted between hinge and frame. Do not insert shims between hinge and door.
- B. To prevent stile failure, insure that door closers are properly adjusted and do not limit the door opening swing. Limit door opening swing only with a properly located stop.
- C. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

3.04 PROTECTION

- A. Do not "prop" doors open with any devices during construction at the base of the door. If this occurs, doors will be rejected and replaced at no cost to the Owner.

- B. Protection of Completed Work: Advise Contractor of proper procedures required for protection of installed wood doors from damage or deterioration until acceptance of work.
- C. One month prior to expiration of warranty per Document 00700 - General Conditions, Contractor to perform walk-thru of all wood door openings and adjust hardware as necessary for proper operation of doors to fully satisfy door manufacturer's warranty.

END OF SECTION

SECTION 08.333 SECURITY GRILLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Upcoiling Security Grilles, manually operated.

1.02 RELATED SECTIONS

A. Section 05.500 - Metal Fabrications: Support framing and framed opening.

B. Section 06.200 - Finish Carpentry: Wood jamb and head trim.

C. Section 08.710 - Door Hardware: Product Requirements for cylinder core and keys.

1.03 REFERENCES

A. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

C. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

D. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.04 SUBMITTALS

A. Submit under provisions of Section 01340.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods.

C. Shop Drawings: Include detailed plans, elevations, details of framing members, required clearances, anchors, and accessories. Include relationship with adjacent materials.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

- E. Verification Samples: For each finish product specified, two samples, representing actual product, color, and patterns.
- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.
- B. Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Install in areas designated by Architect.
 - 2. Do not proceed with remaining work until workmanship and installation is approved by Architect.
 - 3. Refinish mock-up area as required to produce acceptable work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
- C. Store materials in a dry, warm, ventilated weathertight location.

1.07 COORDINATION

- A. Coordinate Work with other operations and installation of adjacent finish materials to avoid damage to installed materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: www.overheaddoor.com. E-mail: info@overheaddoor.com.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01630.

2.02 UPKOILING SECURITY GRILLES

A. Manual Overhead Coiling Aluminum Grilles: Overhead Door Corporation Model 670.

1. Curtain: Horizontal 5/16 inch (7.8 mm) diameter rods with network of vertically interlocking links to form a pattern. Bottom bar extruded aluminum tubular shape.
 - a. Material: Aluminum.
 - b. Vertical Rod Spacing:
 - 1) 2 inches (51 mm) on center.
 - c. Pattern
 - 1) Straight lattice; horizontal spacing 9 inches (228 mm) on center.
2. Finish
 - a. Aluminum clear anodized.
3. Bottom Bar
 - a. Tubular extruded aluminum, clear anodized.
4. Guides
 - a. Extruded aluminum shapes with retainer grooves and continuous silicone treated wool-pile strips or PVC inserts to reduce noise and assist operation.
5. Brackets: Minimum 3/16 inch (4.8 mm) steel to support barrel, counterbalance and hood as applicable.
6. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with maximum deflection of 0.03 inches per foot of span. Counterbalance adjustable by means of an adjusting tension wheel.
7. Hood
 - a. Aluminum, clear anodized with intermediate supports as required.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify opening sizes, tolerances and conditions are acceptable.
- B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07.920.
- F. Install perimeter trim and closures.

3.04 ADJUSTING

- A. Test security grilles for proper operation and adjust as necessary to provide proper operation without binding or distortion.
- B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.05 CLEANING

- A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.
- B. Remove labels and visible markings.
- C. Touch-up, repair or replace damaged products before Substantial Completion.

3.06 PROTECTION

- A. Protect installed products until completion of project.

END OF SECTION

SECTION 08.410 ALUMINUM ENTRANCES, CURTAINWALL AND STOREFRONTS

PART 1 GENERAL

1.01 SUMMARY

- A. Extent of entrance and storefront work is indicated on the Drawings
- B. Work includes, but is not limited to the following:
 - 1. Curtainwall units
 - 2. Storefront units
 - 3. Aluminum entrance units including hardware
 - 4. Frame, transoms and sidelights where indicated.
 - 5. Breakmetal closures at heads, jambs, and sills as indicated on Drawings.
- C. Related Sections include the following:
 - 1. Division 7 Section "Joint Sealants"
 - 2. Division 7 Section "Flashing and Sheet Metal"
 - 3. Division 8 Section "Door Hardware"
 - 4. Division 8 Section "Glazing"

1.02 PERFORMANCE REQUIREMENTS

- A. Wind Design Data
 - 1. Refer to Structural Drawings for additional design data.
 - 2. Design pressure: refer to Structural Drawings.
- B. Manufacturer's Test Procedures and Performance:
 - 1. Test Units
 - a. Air, water, and structural test unit size shall be a minimum of two stories high and three lites wide.
 - b. Thermal test unit sizes shall be 80" wide x 80" high with one intermediate vertical mullion and two lites of glass.
 - 2. Air Infiltration Test
 - a. Test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf (300 Pa).
 - b. Air infiltration shall not exceed .06 cfm/SF (.31 l/s•m²) of unit.
 - 3. Water Resistance Test
 - a. Test unit in accordance with ASTM E 331.
 - b. The test for static water penetration (ASTM E 331) shall be conducted at an air pressure difference of 20% of maximum positive design wind pressure based on ASCE7. There shall be

- no water leakage as defined by AAMA 501.1, paragraph 5.5.
4. Uniform Load Deflection Test
 - a. Test in accordance with ASTM E 330.
 - b. Deflection under design load shall not exceed $L/175$ for spans less than 162".
 - c. Deflection under design load shall not exceed $L/240 + 1/4"$ for spans greater than 162".
 5. Uniform Load Structural Test
 - a. Test in accordance with ASTM E 330 at a pressure 1.5 times the design wind pressure as specified herein.
 - b. At conclusion of the test there shall be no glass breakage, permanent damage to fasteners, curtain wall parts, or any other damage that would cause the curtain wall to be defective.
 6. Condensation Resistance Test (CRF)
 - a. Test unit in accordance with AAMA 1503.1.
 - b. Condensation Resistance Factor (CRF) shall not be less than 74 (frame) when glazed with 0.24 center of glass U-Factor.
 7. Condensation Resistance (CR)
 - a. With ventilators closed and locked, test unit in accordance with NFRC 500-2010.
 - b. Condensation Resistance (CR) shall not be less than 65 when glazed with 0.24 center of glass U-Factor.
 8. Seismic Performance
 - a. Test unit in accordance to AAMA 501.4 system to meet design displacement of $0.010 \times$ the greater adjacent story height and ultimate displacement of $1.5 \times$ the design displacement.
 9. Sound Transmission Loss
 - a. Test unit in accordance with ASTM E 90-02.
 - b. Sound Transmission Class (STC) shall not be less than 29.

1.03 SUBMITTALS

A. Product Data

1. Submit manufacturer's descriptive literature and product specifications.
 - a. Submit component dimensions; describe components within assembly, anchorage and fasteners, glass, internal drainage details and water flow drainage diagrams.

2. Include information for factory finishes, hardware, accessories, and other required components.
 3. Calculations: Submit calculations and loads, signed by a Structural Engineer registered in the State of Mississippi, where such impacts the primary or secondary building structural systems.
- B. Shop Drawings
1. Submit all data developed by the contractor for the purposes of fabrication and assembly of glazed metal curtainwall assemblies. Include framing system and all associated components of the curtainwall system used for preparation of the documents described above.
 2. Indicate system dimensions, framed opening requirements and tolerances, anticipated deflection under load, affected related work, weep drainage network, expansion and contraction joint location and details, and field welding required.
 3. Provide full elevations at a minimum scale of 1/4 inch to 1 foot.
 4. Provide full-size joint details illustrating details, including flashing.
 5. Indicate means of adjustment to accommodate field conditions.
 6. Indicate locations and details for attachment of components to building structure including primary and secondary steel.
- C. Samples
1. Submit 18" long sample of all profiles for approval before starting fabrication.
 2. Submit manufactures samples indicating quality of finish in required colors.
 3. Where normal texture or color variations are expected, include additional samples illustrating range of variation.
- D. Test reports: Indicate substantiating engineering data, test results of previous tests by independent laboratory which purport to meet performance criteria, and other supportive data.

1.04 QUALITY ASSURANCE

- A. To ensure quality of appearance and performance, obtain materials for systems from either a single manufacturer or from manufacturer approved by systems manufacturer.

- B. Standards: Comply with applicable standards of the Aluminum Association.
- C. Pre-installation Conference
 - 1. Arrange with Architect and representatives of storefront, glazing, and sealant manufacturer to visit Project site before beginning to analyze site conditions, and inspect surfaces and joints to be sealed in order that recommendations may be made should adverse conditions exist.
 - 2. Discuss following items:
 - a. Weather conditions under which work will be done.
 - b. Anticipated frequency and extent of joint movement.
 - c. Joint design.
 - d. Glazing procedures.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces as necessary to prevent damage.
- B. Protect pre-finished aluminum surfaces with wrapping or strippable coating and store in a dry location. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Puncture wrappings at ends for ventilation.
- C. Immediately replace materials that become damaged or are otherwise unsuitable for installation, and replace with new materials.

1.06 PROJECT CONDITIONS

- A. Inspect substrates to which work of this section adjoins. Field check all dimensions and elevations on the connecting work affecting the work of this section to insure a proper fit and weathertight construction.

1.07 WARRANTY

- A. Manufacturer's 20 year finish warranty covering checking, crazing, peeling, chalking, fading, or adhesion.
- B. General
 - 1. Warranty period 5 years covering system installation and components.
 - 2. Longer warranties apply as specified herein and in other sections of these Specifications where components are specified which are part of the

assemblies. Replace components with deficiencies such as:

- a. Penetration of water into the building exceeding specified limits.
- b. Air infiltration exceeding specified limits.
- c. Structural failure of components resulting from forces within specified limits.
- d. Failure of operating parts to function normally.

1.08 MAINTENANCE

- A. Furnish maintenance service for a period of 12 months from date of Substantial Completion during normal working hours at no cost to the Owner. Service shall consist of examination of the equipment, adjustment, lubrication, supplies and parts to keep the doors and hardware in proper operation. 1 month prior to expiration of maintenance agreement during warranty "walk-thru", survey all doors and hardware and perform any adjustments if necessary.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Kawneer North America
- B. Oldcastle Building Envelope
- C. EFCO Corporation

2.02 MATERIALS

- A. Aluminum
 1. Extrusions: ASTM B221, alloy 6063-T5; T6 for structural members
- B. Inserts and Anchorage Devices
 1. Manufacturer's standard formed or fabricated assemblies, steel or aluminum, of shapes, plates, bars or tubes.
 2. Hot-dip galvanize steel assemblies after fabrication, comply with ASTM A123, 2.0 ounce minimum coating.
- C. Pressure Plate
 1. Material shall be a fiberglass composite with a Flexural strength of no less than 82 ksi along the lineal's major axis.
 2. Material thermal conductivity shall be no more than 2 BTU•in/hr•ft²•°F.
- D. Flashing: All aluminum flashing (where required) shall be of a sufficient gauge and chemical

composition to satisfy the conditions as described in "aluminum" paragraph above with a minimum thickness of 1/16" (for painted finishes, minimum 3/32"). See Division 7 "Flashing and Sheet Metal for one-piece aluminum subsills beneath curtainwall windows.

E. Fasteners

1. Clamping bars shall be attached to glazing bars by 1/4 -20 stainless steel machine screws.
2. Non-magnetic stainless steel or cadmium plated steel coated with yellow or silver iridescence plating, compatible with materials being fastened.
3. Series 300 stainless steel for exposed locations. Cadmium plated steel with 0.0005 inch plating thickness and color chromate coated for concealed locations.
 - a. Provide countersunk flathead fasteners with finish matching item fastened.
4. Provide nuts or washers of design having means to prevent disengagement; deforming of fastener threads is not acceptable.
5. Provide concealed fasteners wherever possible.

F. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.

G. Shims: Non-staining, non-ferrous, type as recommended by system manufacturer.

H. Protective Coatings: Cold applied asphalt mastic complying with SSPC-Paint 12, compounded for 30 mil thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.

I. Glass: Provide glazing as specified in Division 8 Section "Glazing".

J. Gaskets: Glazing gaskets shall comply with ASTM C 864 and be extruded of a silicone compatible EPDM rubber that provides for silicone adhesion.

K. Sealant materials: Provide sealants materials complying with requirements specified in Division 7 Section "Joint Sealants".

L. High Performance Interlocking flashing at sills of all storefront units.

2.03 CURTAINWALL COMPONENTS

A. Provide curtainwall at all areas with exception of areas indicated to have window units. Provide products from one of the following:

1. "Series 5600 Outside Glazed with Duracast Fiberglass Pressure Plate"; EFCO

2. "Reliance-TC"; Oldcastle Building Envelope
 3. "1600-UT System 1"; Kawneer
- B. Sizes of framing members are as indicated on Drawings. NOTE: some units have different section properties for horizontal and vertical members. Provide internal steel reinforcing where required to meet pressures indicated on Structural Drawings.
- C. Provide all necessary components for complete installation including glazing gaskets for flush glazing and adapters as required to accommodate the following:
1. Glazing as specified in Division 8 Section "Glazing".

2.04 ALUMINUM STOREFRONT FRAMES

- A. Aluminum storefront frames shall be equal to Kawneer, Trifab VG 451T frame system, sized as indicated on the drawings. Approved equals: EFCO Series 403(3); Oldcastle Series 3000XT.
- B. Subsills: Provide and install high performance interlocking flashing at sills of all storefront units, including clips (451HP126) and flashing (451THP037).
- C. Bolts for attachment of mullions to supporting structure shall be cadmium plated steel. Where required, bolts shall be stainless steel 300 Series. Self-tapping screws shall be stainless steel 300 Series.
- D. Steel angles, where required, shall be galvanized in accordance with ASTM Standard A-388.
- E. Aluminum Storefront subcontractor shall be responsible for perimeter anchorage of the system to meet wind design requirements.

2.05 ENTRANCE COMPONENTS

- A. Aluminum Doors:
1. "D318 Durastile HD"; EFCO
 2. "Rugged Door"; Oldcastle Building Envelope
 3. "350 Heavywall"; Kawneer
- B. All door sections shall be of extruded aluminum alloy and temper to meet or exceed finishing and structural criteria as specified.
- C. Doors shall be 2 inches thick. Door stiles and rails, excluding glass stops, shall be tubular and have .188 wall thickness. All weathering shall be a hardbacked silicone treated polypropylene.

- D. Door frames are to also have 3/16" wall thickness.
- E. Fasteners: Aluminum alloys or stainless steel. Exposed fasteners, if any, shall be finished to match door and frame sections.
- F. Exterior Hardware
 - 1. Operating hardware shall be furnished by the aluminum door manufacturer unless otherwise indicated, in accordance with the following schedule:
 - a. Hinges: Continuous "geared" hinge incorporating stainless steel bearings between the knuckles.
 - b. Closers: LCN 4041, Corbin Russwin DC8000 Series, or Sargent 281 Series. Provide heavy duty arms.
 - c. Keyed Aluminum Removable Mullion (provide at all double door locations): Von Duprin 5654, Corbin Russwin 808, or Sargent 650A.
 - (1) Provide 2 stabilizers per mullion.
 - (2) US28 (satin anodized aluminum) finish.
 - d. Rim Exit Device: Von Duprin 98 Series, Corbin Russwin ED4200 Series, or Sargent 8500 Series.
 - (1) Cylinder dogging required - provide cylinder housing and core.
 - (2) US32D (satin stainless) finish with Anti-microbial coating required.
 - e. Pull Handle: Doors shall have a 12 inch tubular pull (316 stainless steel finish with anti-microbial coating) as manufactured by McKinney, Rockwood, or Ives with concealed fasteners.
 - f. Cylinder: cylinder provided by supplier of finish hardware for other doors.
 - (1) See Division 8 Section "Door Hardware" for additional information
 - g. Threshold: Pemko 171A or equal, ADA compliant, mill finish.
 - h. Astragal: Pemko 305CN or equal, clear anodized aluminum finish
 - i. Weatherstripping: Pemko 303AS or equal, clear anodized finish
 - j. Door Sweep: Pemko 345AV or equal, clear anodized finish
 - k. Exposed hardware finish shall match doors and frames unless otherwise indicated.
 - l. Access Control: Where access control is indicated to be furnished under, provide electrified panic hardware and electric strikes in lieu of hardware as specified. Refer and

coordinate with Division 8 Section "Door Hardware" for additional information and equipment.

G. Automatic Openers

1. Coordinate with Division 8 Section "Door Hardware" for wiring and components.

2.06 FABRICATION

A. Aluminum framing

1. Provide members of size, shape and profile indicated, designed to provide for glazing from exterior.
2. Fabricate frame assemblies with joints straight and tight fitting.
3. Reinforce internally with structural members as necessary to support design loads.
4. Maintain accurate relation of planes and angles, with hairline fit of contacting members.
5. Seal horizontals and direct moisture accumulation to exterior.
6. Provide flashings and other materials used internally or externally that are corrosive resistant, non-staining, non-bleeding and compatible with adjoining materials.
7. Provide manufacturer's extrusions and accessories to accommodate expansion and contraction due to temperature changes without detrimental to appearance or performance.
8. Make provisions in framing for minimum edge clearance, nominal edge cover and nominal pocket width for thickness and type of glazing or infill used in accordance with recommendations of manufacturer and FGMA glazing manual.

B. Welding

1. Comply with recommendations of the American Welding Society.
2. Use recommended electrodes and methods to avoid distortion and discoloration.
3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.

C. Flashings: form from sheet aluminum with same finish as extruded sections. Material thickness as required to suit condition without deflection or "oil canning".

2.07 ENTRANCE FABRICATION

- A. Door corner construction shall consist of mechanical clip fastening, SIGMA deep penetration plug welds and 1-1/8" long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type with EPDM glazing gaskets reinforced with non-stretchable cord.
- B. Accurately fit and secure joints and corners. Make joints hairline in appearance.
- C. Prepare components with internal reinforcement for door hardware.
- D. Arrange fasteners and attachments to conceal from view.
- E. All glazing shall be flush, including the horizontal muntins and sills. Glass shall be held in place by EPDM glazing gaskets on both sides. No applied stops shall be permitted.
- F. All door frames shall have door stops at jambs and head with continuous weathering.

2.08 FINISHES

- A. All exposed surfaces shall be free of unsightly scratches and blemishes.
- B. Organic Coating (high performance fluorocarbon)
 - 1. Comply with requirements of AAMA 2605.
 - 2. Surfaces cleaned and given conversion coating pre-treatment prior to application of 0.3 mil dry film thickness of epoxy or acrylic primer following recommendations of finish coat manufacturer.
 - 3. Finish coat of 70% minimum fluorocarbon resin fused to primed surfaces at temperature recommended by manufacturer, 1.0 mil minimum dry film thickness.
 - 4. Color as selected by Architect from manufacturer's full line - including premium colors.

PART 3 EXECUTION

3.01 PREPARATION

- A. Dissimilar Metals
 - 1. In addition to the finish specified, aluminum surfaces against masonry, concrete, wood or steel shall be protected from contact by use of a coat of bituminous paint to prevent galvanic or corrosive action, or as recommended by the manufacturer and approved by the Architect.

3.02 INSTALLATION

- A. Install wall system and punched windows in accordance with AAMA -Metal Curtain Wall, Window, Store Front and Entrance -Guide Specifications Manual and in accordance with manufacturer's recommendations.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances.
- E. Install sill flashings (under subsill): Turn up ends and edges; seal to adjacent Work to form water tight dam. Provide joints between flashing pieces as required to accommodate the thermal movement of the flashing material while maintaining a weathertight seal. Use only non-curing sealant.
 - 1. Install manufacturer's aluminum subsill at the base of all frames set in bed of sealant.
- F. Sealant installation standard: Comply with recommendations of ASTM C 1193 for use of joint sealant as applicable to materials, applications, and conditions indicated.
- G. Installation of sealant backings: Install sealant backings to comply with the following requirements:
 - 1. Install joint backers to provide support of sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint backer.
 - b. Do not stretch, twist, puncture or tear joint backer.
 - c. Remove absorbent joint backer that have become wet prior to sealant application and replace with dry material.
 - 2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint backer or back of joints.
- H. Installation of sealants: Install all sealants by proven techniques that result in sealants directly contacting and fully wetting the joint substrates, completely filling recess provided for each joint configuration, and providing uniform cross-sectional

shapes and depths relative to joint widths that allow optimum sealant movement capability:

1. Fill the sealant rabbet to a slightly concave surface. Tool joints as necessary to assure continuous bonding, obtain a uniform appearance free from defects.
 2. Install sealants to depths as recommended by sealant manufacturer.
 3. Use sealing materials in strict accordance with sealant manufacturer's printed instructions.
- I. Glazing: Comply with "Glazing Manual" by Glass Association of North America except as shown and specified otherwise, and except as specifically recommended otherwise by the manufacturer of the glass and the manufacturer of the glazing materials.
1. Comply with Division 8 Section "Glazing".
 2. Do not mark on installed glass.
 3. Comply with glass manufacturer's instructions and recommendations for possible use of setting blocks.
 4. Before installing glass, check the setting to verify that it is plumb with no edge damage and in a perfect plane suitable for installing.
 5. Do not proceed unless glazing surfaces are dry and free of frost.
 6. Do not attempt to cut, seam, nip, or abrade any fully tempered, heat-strengthened, or coated glass.
 7. Unify appearance of each series of lights by setting each glass piece to match others as nearly as possible. Inspect each glass piece and set with the pattern, draw and bow oriented in the same direction as other pieces.
- J. Sealant curing and protection
1. Cure sealants in compliance with manufacturer's recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.
 2. Ensure procedures required for cure and protection of joint sealants are followed during construction period, so that they will be without deterioration or damage.
 3. Cure and protect sealants in a manner which will minimize increases in modulus of elasticity and other accelerated aging effect. Replace or restore sealants which are damaged or deteriorated during construction period.

K. Entrance Door Installation

1. Doors shall be hung plumb, level and square, and properly secured in accordance with manufacturer's approved shop drawings. Hardware shall be properly installed and adjusted. Final adjustment shall be made for proper and easy operation of the doors after glazing and after air conditioning is in operation.

3.03 TOLERANCES

- A. Maximum variation from plumb: 0.06 inches every 3 feet non-cumulative or 0.5 inches per 100 feet, whichever is less. Maximum misalignment of two adjoining members abutting in plane: 1/32 inch.
- B. Work shall have sharp, clean profiles, be straight and free from defects, dents, marks, waves or flaws.
- C. Glazing rabbets shall be aligned between horizontal and vertical mullions to a tolerance of 1/32 inch total misalignment.
- D. Removable glass stops shall be centered in openings with no more than 1/32 inch gap on each side.

3.04 FIELD QUALITY CONTROL

- A. Notify Architect a minimum of 14 days prior to conducting field tests.
- B. Field test for water leakage by static test method at 12 pounds per square inch water pressure for 15 minutes in accordance with AAMA 503 "Field Check of Water and Air leakage through Installed Exterior Windows, Curtain Walls, and Doors by Uniform Air Pressure Difference"
 1. Test curtain wall assembly AND storefront assembly
 2. Test flashings and perimeter sealant joints at interface to adjacent components or systems.
 3. Test a minimum of 3 lights wide x 2 lights tall.
- C. Perform a test on 5% of installed windows, but no less than 5 complete unit assemblies, with repeat tests when failures occur. Eliminate source of leakage and re-test until no leakage occurs. Submit test reports and photographs.
- D. Corrective work shall be approved by Architect and Consultant before retesting. Corrective work and retesting shall be paid by Contractor (including testing fees and additional service fees of Architect and Consultants).

3.05 ADJUSTING

A. Test door operating functions. Adjust closing and latching speeds and other hardware in accordance with manufacturer's instructions to ensure smooth operation. Adjusting wrenches and small tools furnished with operating hardware shall be turned over the Owner, properly tagged and identified.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. For glass, comply with glass manufacturer's cleaning recommendations. Take care to remove dirt from corners. Wipe surfaces clean.

C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant and glass manufacturer.

3.07 PROTECTION

A. Protect doors and frames from damage during subsequent construction activities. Replace damaged materials at no additional cost to the Owner.

B. Maintain glass units in a reasonably clean condition during construction to prevent damage by corrosive action. Replace broken, cracked or damaged glass.

END OF SECTION

SECTION 08.710 DOOR HARDWARE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Commercial Mechanical door hardware, accessories and/or cylinders for the following:
 - a. Swinging doors.

B. Related Sections include the following:

1. Division 08 Section "Steel Doors and Frames"
2. Division 08 Section "Flush Wood Doors"
3. Division 08 Section "Aluminum-Framed Entrances Curtainwall and Storefronts"

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering and scheduling remain requirements of this Section.

1. Permanent cores to be installed by Owner.

1.03 REFERENCE STANDARDS

A. This Section references the following Codes/Standards:

1. American National Standards Institute (ANSI) (Current Editions)
 - a. ANSI A117.1 - Accessible and Usable Buildings and Facilities
 - b. ANSI A156 (All related Sections)
2. Builders Hardware Manufacturers Association (BHMA) (Current Editions)
 - a. ANSI/BHMA A156.XX (All related Sections)
3. Door and Hardware Institute (DHI)
 - a. DHI/ANSI A115.IG - Installation Guide for Doors and Hardware.
 - b. DHI Sequence and Format for the Hardware Schedule.
 - c. DHI Recommended Locations for Builder's and Architectural Hardware.

4. National Fire Protection Association (NFPA)
(Current Editions)
 - a. NFPA 80 - Fire Doors and Windows
 - b. NFPA 101 - Life Safety Code
5. International Building Code (IBC) (Current Editions)

1.04 SUBMITTALS

- A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Details of electrified door hardware, indicating the following:
 1. Wiring Diagrams: Power, signal, and control wiring. Include the following:
 - a. System schematic.
 - b. Point-to-point wiring diagram.
 - c. Riser diagram.
 - d. Elevation of each door.
 2. Detail interface between electrified door hardware, fire alarm, access control, security and building control systems or other systems as may apply.
 3. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.
- C. Samples for Verification: For exposed door hardware of each type, in specified finish, full size. Tag with full description for coordination with the door hardware sets. Submit Samples before, or concurrent with, submission of the final door hardware sets.
 1. Samples will be returned to Contractor. Units that are acceptable through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- D. Product Certificates: For electrified door hardware, signed by product manufacturer.
 1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.
- E. Qualification Data: For Installer and Architectural Hardware Consultant.
- F. Product Test Reports: If requested by the Architect provide reports based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for locks, latches, delayed-egress locks and closers.

- G. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.
- H. Warranty: Special warranty specified in this Section.
- I. Other Action Submittals:
 - 1. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
 - b. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, and material of each door and frame.
 - 2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
 - 3) Complete designations of every item required for each door or opening including name and manufacturer.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for door hardware.
 - 8) Door and frame sizes and materials.
 - 9) Description of each electrified door hardware function, if applicable, including location, sequence of operation, and interface with other building control systems.
 - a) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit;

unauthorized person wants to enter;
unauthorized person wants to exit.

10) List of related door devices specified in other Sections for each door and frame.

11) Product Cut Sheets for all material scheduled.

c. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.

2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant (AHC), detailing Owner's final keying instructions for locks as determined at Key Conference. Include schematic keying diagram and index each key set to unique door designations.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.

1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

2. Installer shall have warehousing facilities in Project's vicinity.

3. Scheduling Responsibility: Preparation of door hardware and keying schedules.

4. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant (AHC) Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant (AHC) and who is experienced in providing consulting services for door hardware installations that are

comparable in material, design, and extent to that indicated for this Project.

1. Electrified Door Hardware Consultant Qualifications: A qualified Architectural Hardware Consultant (AHC) who is experienced in providing consulting services for electrified door hardware installations.
- C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches or less above the sill.
- E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Keying Conference: If required by the Architect, conduct conference at a location to comply with requirements in Division 01 Section "Project Management and Coordination." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 2. Preliminary key system schematic diagram.
 3. Requirements for key control system.
 4. Address for delivery of keys.
- G. Pre-installation Conference: If required by the Architect, conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to electrified door

hardware including, but not limited to, the following:

1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
2. Review sequence of operation for each type of electrified door hardware.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review required testing, inspecting, and certifying procedures.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys and permanent cores, if applicable, to Owner by hand delivery, registered mail or overnight package service.

1.07 COORDINATION

- A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system and building control system as applicable for this project.
- C. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.

b. Faulty operation of operators and door hardware.

c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: 3 years from date of Substantial Completion, except as follows:

a. Bored Locksets: 7 years from date of Substantial Completion.

b. Mortise Locksets: 10 years from date of Substantial Completion.

c. Exit Devices: 5 years from date of Substantial Completion.

d. Manual Closers: 10 years from date of Substantial Completion.

1.09 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide 6 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

PART 2 PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and door

hardware sets indicated in Part 3 "Door Hardware Sets" Article.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required provide as specified.
 2. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.
- C. In other Part 2 articles where titles below introduce lists of approved Manufacturers, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 HINGES, GENERAL

- A. Quantity: Provide the following, unless otherwise indicated:
1. Two Hinges: For doors with heights up to 60 inches.
 2. Three Hinges: For doors with heights 61 to 90 inches.
 3. Four Hinges: For doors with heights 91 to 120 inches.
 4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
- B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- C. Hinge Weight: Unless otherwise indicated, provide the following:
1. Entrance Doors: Heavy weight antifriction-bearing hinges.

2. Doors with Closers: Standard weight antifriction-bearing hinges.
 3. Interior Doors: Standard weight hinges. Provide antifriction-bearing as specified in Part 3 "Door Hardware Sets" Article.
- D. Hinge Base Metal: Unless otherwise indicated, provide the following:
1. Exterior Hinges: Stainless steel, with stainless-steel pin or brass, with stainless-steel pin body and brass protruding heads as specified in Part 3 "Door Hardware Sets" Article.
 2. Interior Hinges: Brass, with stainless-steel pin body and brass protruding heads, Steel, with steel pin or Stainless steel, with stainless-steel pin as specified in Part 3 "Door Hardware Sets" Article.
 3. Hinges for Fire-Rated Assemblies: Steel, with steel pin, Stainless steel, with stainless-steel pin as specified in Part 3 "Door Hardware Sets" Article.
- E. Hinge Options: Where indicated in door hardware sets or on Drawings:
1. Hospital Tips: Slope ends of hinge barrel.
 2. Decorator Tips: Oval, Ball, Steeple, Urn, Acorn as specified in Part 3 "Door Hardware Sets" Article.
 3. Safety Stud: Designed for stud in one leaf to engage hole in opposing leaf.
 4. Maximum Security Pin: Fix pin in hinge barrel after it is inserted.
 5. Non-removable Pins (NRP): Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors and outswinging corridor doors with locks.
 6. Corners: Square.
- F. Electrified Functions for Hinges: Comply with the following:
1. Power Transfer: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle.
 2. Monitoring: Concealed electrical monitoring switch.
 3. Power Transfer and Monitoring: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle, and with concealed electrical monitoring switch.

- G. Fasteners: Comply with the following:
1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
 2. Wood Screws: For wood doors and frames.
 3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
 4. Screws: Phillips flat-head machine screws (drilled and tapped holes) for metal doors and wood screws for wood doors and frames (Pilot holes required for wood doors and/or frames). For NRP hinges finish screw heads to match surface of hinges.

2.03 HINGES

- A. Butts and Hinges: BHMA A156.1. Listed under Category A in BHMA's "Certified Product Directory."
- B. Template Hinge Dimensions: BHMA A156.7.
- C. Approved Manufacturers:
 1. Hager Companies.
 2. Bommer Hinge.
 3. Stanley Hardware.

2.04 CONTINUOUS HINGES

- A. Standard: BHMA A156.26. Listed under Category N in BHMA's "Certified Product Directory."
- B. General: Minimum 0.120-inch thick, hinge leaves with minimum overall width of 4 inches fabricated to full height of door and frame as recommended by the Manufacturer.
 1. Fire Pins: Steel pins to hold labeled fire doors in place if required by tested listing.
- C. Continuous, Pin & Barrel Hinges: Hinge with knuckles formed around a pin that extends entire length of hinge.
 1. Base Metal for Exterior Hinges: Stainless steel.
 2. Base Metal for Interior Hinges: Stainless steel or steel.
 3. Base Metal for Hinges for Fire-Rated Assemblies: Stainless steel or steel.
 4. Approved Manufacturers:
 - a. Select Products.
 - b. Stanley Hardware.
 - c. Zero International.
- D. Continuous, Geared Hinges: Extruded-aluminum, geared hinge leaves joined by a continuous extruded-aluminum channel cap with concealed, self-lubricating thrust bearings.

1. Approved Manufacturers
 - a. Select Products.
 - b. Stanley Hardware.
 - c. Zero International.

2.05 LOCKS AND LATCHES, GENERAL

- A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ANSI A117.1.
 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
- B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- C. Electrified Locking Devices: BHMA A156.25.
 1. Provide as specified in Part 3 "Door Hardware Sets" Article.
- D. Lock Trim:
 1. Levers: Provide as specified in Part 3 "Door Hardware Sets" Article.
 2. Escutcheons (Roses): Provide as specified in Part 3 "Door Hardware Sets" Article.
 3. Dummy Trim: Match lock trim and escutcheons.
 4. Lockset Designs: Provide as specified in Part 3 "Door Hardware Sets" Article.
- E. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors and as follows:
 1. Bored Locks: Minimum 1/2-inch latchbolt throw.
 2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
 3. Deadbolts: Minimum 1-inch bolt throw.
- F. Backset: 2-3/4 inches, unless otherwise indicated.
- G. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:
 1. Strikes for Bored Locks and Latches: BHMA A156.2.
 2. Strikes for Mortise Locks and Latches: BHMA A156.13.
 3. Strikes for Auxiliary Deadlocks: BHMA A156.5.

4. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
5. Extended Lip Strikes: For locks used on frames requiring the additional length to protect frame and trim.
6. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

2.06 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
 1. Mortise Locks: BHMA A156.13.
 2. Interconnected Locks: BHMA A156.12.
- B. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13. Listed under Category F in BHMA's "Certified Product Directory."
 1. Approved Manufacturers:
 - a. Best Access Systems.
 - b. Sargent Manufacturing Company.
 - c. Schlage Commercial Lock.

2.07 AUXILIARY LOCKS AND LATCHES

- A. Auxiliary Locks: BHMA A156.5 Listed under Category E in BHMA's "Certified Product Directory."
 1. Approved Manufacturers:
 - a. Accurate Lock & Hardware Co.
 - b. Adams Rite Manufacturing Co.
 - c. Best Access Systems.

2.08 ELECTROMAGNETIC LOCKS

- A. General: BHMA A156.23; electrically powered, of strength and configuration indicated; with electromagnet attached to frame and armature plate attached to door or as required for proper application. Listed under Category E in BHMA's "Certified Product Directory."
 1. Type: Full exterior or full interior, as required by application indicated.
 2. Strength Ranking: Provide as specified in Part 3 "Door Hardware Sets" Article.
 3. Residual Magnetism: Not more than 0 lbf to separate door from magnet.
- B. Delayed-Egress Locks: BHMA A156.24. Listed under Category G in BHMA's "Certified Product Directory."

1. Means of Egress Doors: Lock releases within 15 seconds after applying a force not more than 15 lbf for not more than 3 seconds, as required by NFPA 101.
 2. Security Grade: Activated from secure side of door by initiating device.
 3. Movement Grade: Activated by door movement as initiating device.
- C. Approved Manufacturers:
1. Securitron.
 2. Schlage.
 3. Stanley.

2.09 ELECTROMECHANICAL LOCKS

- A. General: Grade 1 unless Grade 2 is indicated for type of lock indicated; motor or solenoid driven.
- B. Approved Manufacturers:
1. Best Access Systems.
 2. Schlage.

2.10 DOOR BOLTS

- A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
1. Dutch-Door Bolts: Minimum 3/4-inch throw.
 2. Mortise Flush Bolts: Minimum 3/4-inch throw.
- B. Dustproof Strikes: BHMA A156.16, Grade 1.
- C. Surface Bolts: BHMA A156.16, Grade 1 unless Grade 2 is indicated.
1. Flush Bolt Heads: Minimum of 1/2-inch diameter rods of brass, bronze, or stainless steel with minimum 12-inch long rod for doors up to 84 inches in height. Provide longer rods as necessary for doors exceeding 84 inches.
 2. Approved Manufacturers:
 - a. Burns Manufacturing Incorporated.
 - b. Don-Jo Mfg., Inc.
 - c. Trimco.
- D. Manual Flush Bolts: BHMA A156.16, Grade 1 unless Grade 2 is indicated designed for mortising into door edge.
1. Approved Manufacturers:
 - a. Burns Manufacturing Incorporated.
 - b. Don-Jo Mfg., Inc.
 - c. Trimco.

- E. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1 unless Grade 2 is indicated designed for mortising into door edge.
 - 1. Approved Manufacturers:
 - a. Burns Manufacturing Incorporated.
 - b. Don-Jo Mfg., Inc.
 - c. Trimco.

2.11 EXIT DEVICES

- A. Exit Devices: BHMA A156.3, Grade 1 unless Grade 2 is indicated. Listed under Category G in BHMA's "Certified Product Directory."
- B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ANSI A117.1.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
- C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- E. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
- F. Removable Mullions: BHMA A156.3.
- G. Fire-Exit Removable Mullions: Provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions shall be used only with exit devices for which they have been tested.

- H. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 - 1. Operation: Rigid or movable as specified in Part 3 "Door Hardware Sets" Article.
- I. Outside Trim: Material and finish to match locksets, unless otherwise indicated.
 - 1. Match design for locksets and latchsets, unless otherwise indicated.
- J. Through Bolts: For exit devices and trim on metal doors, non-fire-rated wood doors and fire-rated wood doors as specified in Part 3 "Door Hardware Sets" Article.
- K. Approved Manufacturers
 - 1. Precision Hardware, Inc.
 - 2. Sargent Manufacturing Company.
 - 3. Von Duprin.

2.12 LOCK CYLINDERS

- A. Standard Lock Cylinders: BHMA A156.5, Grade 1.
- B. High-Security Lock Cylinders: BHMA A156.30, Grade 1.
 - 1. Key Control Level: Category A.
 - 2. Destructive Test Level: Category A.
 - 3. Surreptitious Entry Resistance Level: Category A.
- C. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
 - 1. Number of Pins: Six or Seven pin as required for this project.
 - 2. Mortise Type: Threaded cylinders with rings and cam as required for proper lock operation.
 - 3. Rim Type: Cylinders with back plate, flat type vertical or horizontal tailpiece and raised trim ring.
 - 4. Bored-Lock Type: Cylinders with tailpieces as required for proper lock operation.
 - a. High-Security Grade: BHMA A156.5, Grade 1A, listed and labeled as complying with pick and drill resistant testing requirements in UL 437 (Suffix A).
- D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
 - 1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

2. Removable Cores: Core insert, removable by use of a special key; for use only with core manufacturer's cylinder and door hardware.
- E. Construction Keying: Comply with the following:
 1. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
 2. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
 - a. Replace construction cores with permanent cores as directed by Owner or Architect.
- F. Manufacturer: Same manufacturer as for locks and latches.
- G. Approved Manufacturers
 1. Best Access Systems. CORMAX
- H. INSTALLATION OF THE BEST PERMANENT CORES BY BIDDER IN THIS SECTION 08710.

2.13 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:
 1. No Master Key System: Cylinders are operated by change keys only.
 2. Master Key System: Cylinders are operated by a change key and a master key.
 3. Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.
 4. Great-Grand Master Key System: Cylinders are operated by a change key, a master key, a grand master key, and a great-grand master key.
 5. Existing System: Master key or grand master key locks to Owner's existing system.
 6. Existing System: Re-key Owner's existing master key system into new keying system.
 7. Keyed Alike: Key all cylinders to same change key.
- B. Keys: Nickel silver.
 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation.
 - a. Notation: As specified and determined at keying conference.
 2. Quantity: In addition to one extra key blank for each lock, provide the following:

- a. Cylinder Change Keys: Three.
- b. Master Keys: Five.
- c. Grand Master Keys: Five.
- d. Great-Grand Master Keys: Five.

2.14 KEY CONTROL SYSTEM

- A. Key Control Cabinet: BHMA A156.5, Grade 1; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
 - 1. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
- B. Cross-Index System: Multiple index system for recording key information as specified in Part 3 "Door Hardware Sets" Article. Include three receipt forms for each key-holding hook. Set up by Hardware Distributor.
 - 1. Approved Manufacturers
 - a. Lund Equipment Co., Inc.
 - b. MMF Industries.
 - c. Telkee.

2.15 ELECTRIC STRIKES

- A. Standard: BHMA A156.31, Grade 1.
- B. General: Use fail-secure electric strikes with fire-rated devices.
- C. Approved Manufacturers
 - 1. HES, Inc.
 - 2. Stanley Hardware, Inc.

2.16 OPERATING TRIM

- A. Standard: BHMA A156.6 and as illustrated on Drawings.
- B. Materials: Fabricate from aluminum, brass, bronze or stainless steel, unless otherwise indicated in Part 3 "Door Hardware Sets" Article.
- C. Approved Manufacturers
 - 1. Burns Manufacturing Incorporated.
 - 2. Don-Jo Mfg., Inc.
 - 3. Trimco.

2.17 CLOSERS

- A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are

indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ANSI A117.1.

1. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
- B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
- C. Hold-Open Closers/Detectors: Coordinate and interface integral smoke detector and closer device with fire alarm system.
- D. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
- E. Surface Closers: BHMA A156.4, Grade 1 unless Grade 2 is indicated. Listed under Category C in BHMA's "Certified Product Directory." Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
 1. Approved Manufacturers
 - a. Stanley Commercial Hardware.
 - b. Sargent Manufacturing Company.
 - c. Stanley Door Closer.
- F. Coordinators: BHMA A156.3.
 1. Approved Manufacturers:
 - a. Burns Manufacturing Incorporated.
 - b. Don-Jo Mfg., Inc.
 - c. Trimco.

2.18 PROTECTIVE TRIM UNITS

- A. Size: 2 inches less than door width on push side and 1 inch less than door width on pull side, by height specified in door hardware sets.
- B. Fasteners: Manufacturer's standard machine or self-tapping screws.

- C. Metal Protective Trim Units: BHMA A156.6; beveled top and 3 sides (B4E); fabricated from material as specified in Part 3 "Door Hardware Sets" Article.
 - 1. Material: 0.050-inch thick.
 - 2. Approved Manufacturers:
 - a. Burns Manufacturing Incorporated.
 - b. Don-Jo Mfg., Inc.
 - c. Trimco.

2.19 STOPS AND HOLDERS

- A. Stops and Bumpers: BHMA A156.16, Grade 1.
 - 1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.
- B. Mechanical Door Holders: BHMA A156.16, Grade 1.
- C. Combination Floor and Wall Stops and Holders: BHMA A156.8, Grade 1.
- D. Combination Overhead Stops and Holders: BHMA A156.8, Grade 1.
- E. Electromagnetic Door Holders: BHMA A156.15. Listed under Category C in BHMA's "Certified Product Directory."
 - 1. Coordinate with fire detectors and interface with fire alarm system for labeled fire door assemblies.
- F. Silencers for Wood Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum 5/8 by 3/4 inch fabricated for drilled-in application to frame.
- G. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch fabricated for drilled-in application to frame.
- H. Approved Manufacturers
 - 1. Burns Manufacturing Incorporated.
 - 2. Don-Jo Mfg., Inc.
 - 3. Trimco.

2.20 DOOR GASKETING

- A. Standard: BHMA A156.22. Listed under Category J in BHMA's "Certified Product Directory."
- B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
 2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
 3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- C. Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.
- D. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.
1. Provide smoke-labeled gasketing on 20-minute-rated doors and on fire and/or smoke-labeled doors.
- E. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches or less above the sill].
- F. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
- G. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- H. Gasketing Materials: ASTM D 2000 and AAMA 701/702.
- I. Approved Manufacturers
1. National Guard Products.
 2. Zero International.

2.21 THRESHOLDS

- A. Standard: BHMA A156.21. Listed under Category J in BHMA's "Certified Product Directory."
- B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ANSI A117.1.

1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
- C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch high.
- D. Approved Manufacturers
 1. National Guard Products.
 2. Zero International.

2.22 MISCELLANEOUS DOOR HARDWARE

- A. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosures; filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labeled for use with fire alarm systems.
- B. Auxiliary Hardware: BHMA A156.16, Grade 1.
 1. Approved Manufacturers:
 - a. Burns Manufacturing Incorporated.
 - b. Don-Jo Mfg., Inc.
 - c. Trimco.

2.23 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
- C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units

already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Steel Machine or Wood Screws: For the following fire-rated applications:
 - a. Mortise hinges to doors.
 - b. Strike plates to frames.
 - c. Closers to doors and frames.
3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:
 - a. Surface hinges to doors.
 - b. Closers to doors and frames.
 - c. Surface-mounted exit devices.
4. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.24 FINISHES

- A. Standard: BHMA A156.18, as indicated in door hardware sets.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Steel Doors and Frames: Comply with DHI A115 Series.
 - 1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.
- B. Wood Doors: Comply with DHI A115-W Series. Drill pilot holes of appropriate size for ALL wood door installations.

3.03 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated on Drawings and/or as follows unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
 - 3. Drill pilot holes of appropriate size for ALL wood door installations.

- C. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- D. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated verify location with Architect.
 - 1. Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- F. INSTALLATION OF THE BEST PERMANENT CORES BY BIDDER IN THIS SECTION 08710.

3.04 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
 - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 3. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- B. Occupancy Adjustment: Approximately 6 months after date of Substantial Completion, Installer shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.05 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.

- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SETS

HARDWARE SET # 01 - MAIN ENTRY (2-3080/ALXAL/UL/AC)

DOOR(S): 100, 111a, 115a, 121d

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
2	EA	CYLINDER	12E-72 CORMAX (RIM) OR 1E-74 (MORTISE) AS REQUIRED (CYL DOGGING/ED TRIM	626	BST
1	EA	POWER SUPPLY	SA3000 POWER SUPPLY/ENCL.	GY	BB
1	EA	CARD READER	FELICA/MAGSTRIPE DOOR READER DR4100	STD	BB
2	EA	MAGLOCKS	M62/MM15 WITH DPS	630	SE
1	EA	PUSH BUTTON	TS14	630	AC
1		PIR/REQUEST EXIT	310	WH	HO
1	EA	ACCESS CONTROL	SA3000 MASTER CONTROLLER	GY	BB

NOTE (S): INSTALLATION OF THE ELECTRONIC ACCESS CONTROL, HARDWARE WITH PROVIDING & PULLING OF ACCESS CABLE BY BIDDER IN THIS SECTION.

BALANCE OF ALL MATERIAL/HARDWARE BY DOOR SUPPLIER

VERIFY 45 MINUTE RATING FOR THESE OPENINGS

HARDWARE SET # 02 - STAIR (36710/WDXHM/UL)

DOOR(S): 101a, 101b, 101c, 117a, 117b, 117c, 128a, 128c,

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB179 4.5 X 4.5	652	STN
1	EA	RIM EXIT DEVICE	3RO FL 2114 X 4914D (PASSAGE)	630	PHI
1	EA	CLOSER	CLD-4550 CS SN (MOUNT PARALLEL ARM - PUSH SIDE)	689	SDC
1	EA	FLOOR STOP	1215 CKU	626	TRM
1	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
1	EA	SEAL	5050C X LAR (HEAD/JAMBS)	BLK	NGP

HARDWARE SET # 03 - MECHANICAL, ELEV ROOM (30710/WDXHM/UL)

DOOR(S): 102a, 309

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB179 4.5 X 4.5	652	STN
1	EA	LOCKSET	45H7D14J CORMAX (STOREROOM)	626	BST
1	EA	CLOSER	CLD-4550 SN (MOUNT REGULAR ARM - PULL SIDE)	689	SDC
1	EA	FLOOR STOP	1215 CKU (DR 102 ONLY)	626	TRM
1	EA	OVERHEAD STOP	9020 SERIES (DR 309 ONLY)	626	ABH
1	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
1	EA	SEAL	5050C X LAR (HEAD/JAMBS)	BLK	NGP

HARDWARE SET # 04 MECHANICAL EXTERIOR (40710/HMXHM)

DOOR(S): 102b,

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB199 5 X 4.5 NRP	630	STN
1	EA	LOCKSET	45H7D14J CORMAX (STOREROOM)	626	BST
1	EA	CLOSER	CLD-4550 CS SN (MOUNT PARALLEL ARM - PUSH SIDE)	689	SDC
1	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
1	EA	SEAL	5050C X LAR (HEAD/JAMBS)	BLK	NGP
1	EA	HD FLOOR STOP	1209 (MOUNT AT MAX SWING OF CLOSER)	630	TRM
1	EA	SWEEP	601 A X LAR	AL	NGP
1	EA	THRESHOLD	425 X LAR X FASTENERS FOR SECURE ATTACHMENT TO SUBSTRATE	AL	NGP
1	EA	DRIP CAP	16A X OFW	AL	NGP

HARDWARE SET # 05 - CUSTODIAL CLOSET (30710/WDXHM)

DOOR(S): 103, 202, 302,

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB179 4.5 X 4.5	652	STN
1	EA	LOCKSET	45H7R14J CORMAX (CLASSROOM)	626	BST
1	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
1	EA	FLOOR STOP	1215 CKU	626	TRM
3	EA	SILENCER	1229A (HM FRAME) OR 1229B (WD FRAME) AS REQ'D	GREY	TRM

HARDWARE SET # 06 - CLASSROOM (30710/WDXHM)

DOOR(S): 104a, 104b, 105a, 105b, 106a, 106b, 107a, 107b,

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB179 4.5 X 4.5	652	STN
1	EA	RIM EXIT DEVICE	3RO 2108 X 4908D (CLASSROOM)	630	PHI
1	EA	CLOSER	CLD-4550 SN (MOUNT PARALLEL ARM - PUSH SIDE)	689	SDC
1	EA	FLOOR STOP	1215 CKU	626	TRM
1	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
3	EA	SILENCER	1229A (HM FRAME) OR 1229B (WD FRAME) AS REQ'D	GREY	TRM

HARDWARE SET # 07 - CLASSROOM (30710/WDXHM/UL)

DOOR(S): 118a, 118b, 119a, 119b, 203a, 203b, 204a, 204b, 205a, 205b, 216a, 216b, 304a, 304b, 306a, 306b, 322, 340

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB179 4.5 X 4.5	652	STN
1	EA	RIM EXIT DEVICE	3RO FL 2108 X 4908D (CLASSROOM)	630	PHI
1	EA	CLOSER	CLD-4550 SN (MOUNT PARALLEL ARM - PUSH SIDE)	689	SDC
1	EA	FLOOR STOP	1215 CKU	626	TRM
1	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
1	EA	SEAL	5050C X LAR (HEAD/JAMBS)	BLK	NGP

HARDWARE SET # 08 - FOOD SERVICE EXTERIOR (30710/HMXHM)

DOOR(S): 108a

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB199 4.5 X 4.5 NRP	630	STN
1	EA	LOCKSET	45H7D14J CORMAX (STOREROOM)	626	BST
1	EA	CLOSER	CLD-4550 CS SN (MOUNT PARALLEL ARM - PUSH SIDE)	689	SDC
1	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
1	EA	SEAL	5050C X LAR (HEAD/JAMBS)	BLK	NGP
1	EA	HD FLOOR STOP	1209 (MOUNT AT MAX SWING OF CLOSER)	630	TRM
1	EA	SWEEP	601 A X LAR	AL	NGP
1	EA	THRESHOLD	425 X LAR X FASTENERS FOR SECURE ATTACHMENT TO SUBSTRATE	AL	NGP
1	EA	DRIP CAP	16A X OFW	AL	NGP

HARDWARE SET # 09 - CROSS CORRIDOR (2-3080/ALXAL/UL)

DOOR(S): 109, 111b, 115b, 121a, 121b, 121c

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
2	EA	CONTINUOUS HGE	661HD X LAR	AL	STN
1	EA	MULLION	KR FL 822 X LAR X STABILIZERS	689	PHI
2	EA	RIM EXIT DEVICE	3RO FL 2414 X 2914D (PASSAGE)	630	PHI
1	EA	CYLINDER	12E-72 CORMAX (RIM) (MULLION)	626	BST
2	EA	CLOSER	CLD-4550 SN (MOUNT PARALLEL ARM - PUSH SIDE)	689	SDC
2	SET	SPACERS/BRKTS	CLOSER DROP PLATE/SPACERS AND BRACKETS AS REQUIRED FOR SECURE INSTALLATION	689	SDC
2	EA	FLOOR STOP	1215 CKU	626	TRM

NOTE (S):

BALANCE OF ALL SEALS BY DOOR SUPPLIER

HARDWARE SET # 10 - IT, MEDIA CONTROL, STORAGE, PENTHSE ACCESS (30710/WDXHM)

DOOR(S): 113, 125, 127, 206, 220, 308, 305a, 334, 337, 339, 340a

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB179 4.5 X 4.5	652	STN
1	EA	LOCKSET	45H7D14J CORMAX (STOREROOM)	626	BST
1	EA	FLOOR STOP	1215 CKU	626	TRM
3	EA	SILENCER	1229A (HM FRAME) OR 1229B (WD FRAME) AS REQ'D	GREY	TRM

HARDWARE SET # 11 - ELECTRICAL (30710/WDXHM/UL)

DOOR(S): 114, 116, 207

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB179 4.5 X 4.5 NRP	652	STN
1	EA	RIM EXIT DEVICE	3RO FL 2103 X 4903D (STOREROOM)	630	PHI
1	EA	CLOSER	CLD-4550 CS SN (MOUNT PARALLEL ARM - PUSH SIDE)	689	SDC
1	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
1	EA	SEAL	5050C X LAR (HEAD/JAMBS)	BLK	NGP

HARDWARE SET # 12 - RESTROOM (30710/WDXHM)

DOOR(S): 122, 123, 217, 218, 311, 312

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB179 4.5 X 4.5	652	STN
1	SET	PUSH/PULL SET	1895-4 4 X 16	630	TRM
1	EA	DEADBOLT	8T37S CORMAX (CLASSROOM)	626	BST
1	EA	CLOSER	CLD-4550 SN (MOUNT REGULAR ARM - PULL SIDE)	689	SDC
1	EA	FLOOR STOP	1215 CKU	626	TRM
1	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
1	EA	PROTECTION PLT	KO050 6" X 2" LDW X B4E/CSK (MOP-PULL)	630	TRM
3	EA	SILENCER	1229A (HM FRAME) OR 1229B (WD FRAME) AS REQ'D	GREY	TRM

DOOR HARDWARE

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HARDWARE SET # 13 - AUDITORIUM CORRIDOR (2-30710/HMXHM/UL)

DOOR(S): 124a, 219,

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
8	EA	HINGE	FBB168 4.5 X 4.5 NRP	652	STN
1	EA	MULLION	KR FL 822 X LAR	689	PHI
2	EA	RIM EXIT DEVICE	3RO FL 2108 X 4908D (CLASSROOM)	630	PHI
3	EA	CYLINDER	12E-72 CORMAX (RIM) (MULLION/ED TRIM)	626	BST
2	EA	CLOSER	CLD-4550 CS SN (MOUNT PARALLEL ARM - PUSH SIDE)	689	SDC
2	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
1	EA	SEAL	5050C X LAR (HEAD/JAMBS)	BLK	NGP

HARDWARE SET # 14 - AUD CORR EXTERIOR EXIT (40710/HMXHM)

DOOR(S): 124b

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB199 5 X 4.5 NRP	630	STN
1	EA	RIM EXIT DEVICE	3RO 2103 CD X 4903D (STOREROOM)	630	PHI
1	EA	CYLINDER	12E-72 CORMAX (RIM) (ED TRIM)	626	BST
1	EA	CYLINDER	1E-74 CORMAX (MORTISE) (CYLINDER DOGGING)	626	BST
1	EA	CLOSER	CLD-4550 CS SN (MOUNT PARALLEL ARM - PUSH SIDE)	689	SDC
1	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
1	EA	SEAL	5050C X LAR (HEAD/JAMBS)	BLK	NGP
1	EA	HD FLOOR STOP	1209 (MOUNT AT MAX SWING OF CLOSER)	630	TRM
1	EA	SWEEP	601 A X LAR	AL	NGP
1	EA	THRESHOLD	425 X LAR X FASTENERS FOR SECURE ATTACHMENT TO SUBSTRATE	AL	NGP
1	EA	DRIP CAP	16A X OFW	AL	NGP

HARDWARE SET # 15 - STAIR EXTERIOR (30710/HMXHM)

DOOR(S): 128b

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB199 4.5 X 4.5 NRP	630	STN
1	EA	RIM EXIT DEVICE	3RO 2101 EXIT ONLY (NO O/S TRIM PLATE)	626W	PHI
1	EA	CLOSER	CLD-4550 CS SN (MOUNT PARALLEL ARM - PUSH SIDE)	689	SDC
1	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
1	EA	SEAL	5050C X LAR (HEAD/JAMBS)	BLK	NGP
1	EA	HD FLOOR STOP	1209 (MOUNT AT MAX SWING OF CLOSER)	630	TRM
1	EA	SWEEP	601 A X LAR	AL	NGP
1	EA	THRESHOLD	425 X LAR X FASTENERS FOR SECURE ATTACHMENT TO SUBSTRATE	AL	NGP
1	EA	DRIP CAP	16A X OFW	AL	NGP

HARDWARE SET # 16 - AUDITORIUM (36710/WDXHM)

DOOR(S): 129a, 129b,

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB168 5 X 4.5 NRP	630	STN
1	EA	RIM EXIT DEVICE	3RO 2108 CD X 4908D (CLASSROOM)	630	PHI
1	EA	CYLINDER	12E-72 CORMAX (RIM) (ED TRIM)	626	BST
1	EA	CYLINDER	1E-74 CORMAX (MORTISE) (CYLINDER DOGGING)	626	BST
1	EA	CLOSER	CLD-4550 SN (MOUNT PARALLEL ARM - PUSH SIDE)	689	SDC
1	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
1	EA	FLOOR STOP	1215 CKU	626	TRM
3	EA	SILENCER	1229A (HM FRAME) OR 1229B (WD FRAME) AS REQ'D	GREY	TRM

HARDWARE SET # 17 - BACKSTAGE ACCESS (30710/WDXHM)

DOOR(S): 130a, 130b,

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB179 4.5 X 4.5	652	STN
1	SET	PUSH/PULL SET	1895-4 4 X 16	630	TRM
1	EA	CLOSER	CLD-4550 SN (MOUNT REGULAR ARM - PULL SIDE)	689	SDC
1	EA	FLOOR STOP	1215 CKU	626	TRM
1	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
3	EA	SILENCER	1229A (HM FRAME) OR 1229B (WD FRAME) AS REQ'D	GREY	TRM

HARDWARE SET # 18 - BACKSTAGE EXIT (2-30710/HMXHM)

DOOR(S): 130c, 130d

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
8	EA	HINGE	FBB199 4.5 X 4.5 NRP	630	STN
1	EA	MULLION	KR 822 X LAR	689	PHI
2	EA	RIM EXIT DEVICE	3RO 2103 CD X 4903D (STOREROOM)	626W	PHI
3	EA	CYLINDER	12E-72 CORMAX (RIM) (MULLION/ED TRIM)	626	BST
1	EA	CYLINDER	1E-74 CORMAX (MORTISE) (CYLINDER DOGGING)	626	BST
2	EA	CLOSER	CLD-4550 SN (MOUNT PARALLEL ARM - PUSH SIDE)	689	SDC
2	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
1	EA	SEAL	5050C X LAR (HEAD/JAMBS)	BLK	NGP
2	EA	HD FLOOR STOP	1209 (MOUNT AT MAX SWING OF CLOSER)	630	TRM
2	EA	SWEEP	601 A X LAR	AL	NGP
1	EA	THRESHOLD	425 X LAR X FASTENERS FOR SECURE ATTACHMENT TO SUBSTRATE	AL	NGP
1	EA	DRIP CAP	16A X OFW	AL	NGP

HARDWARE SET # 19 - MECHANICAL EXTERIOR (2-30710/HMXHM)

DOOR(S): 131

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
8	EA	HINGE	FBB199 4.5 X 4.5 NRP	630	STN
1	EA	FLUSHBOLT	3917-12 (BOTTOM)	626	TRM
1	EA	FLUSHBOLT	3917-24 (TOP)	626	TRM
1	EA	LOCKSET	45H7D14J CORMAX (STOREROOM)	626	BST
1	EA	CLOSER	CLD-4550 CS SN (MOUNT PARALLEL ARM - PUSH SIDE) (ACTIVE LEAF)	689	SDC
1	EA	OVERHEAD STOP	9020 SERIES (INACTIVE LEAF)	626	ABH
2	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
1	EA	SEAL	5050C X LAR (HEAD/JAMBS)	BLK	NGP
2	EA	HD FLOOR STOP	1209 (MOUNT AT MAX SWING OF CLOSER)	630	TRM
2	EA	SWEEP	601 A X LAR	AL	NGP
1	EA	THRESHOLD	425 X LAR X FASTENERS FOR SECURE ATTACHMENT TO SUBSTRATE	AL	NGP
1	EA	DRIP CAP	16A X OFW	AL	NGP

HARDWARE SET # 20 – NOT USED

HARDWARE SET # 21 - STORAGE (2-30710/WDXHM)

DOOR(S): 201, 216c, 216d, 243, 244, 301, 303

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
8	EA	HINGE	FBB179 4.5 X 4.5 NRP	630	STN
1	EA	FLUSHBOLT	3917-12 (BOTTOM)	626	TRM
1	EA	FLUSHBOLT	3917-24 (TOP)	626	TRM
1	EA	LOCKSET	45H7D14J CORMAX (STOREROOM)	626	BST
1	EA	CLOSER	CLD-4550 SN (MOUNT REGULAR ARM - PULL SIDE) (ACTIVE LEAF)	689	SDC
2	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
2	EA	FLOOR STOP	1215 CKU	626	TRM
2	EA	SILENCER	1229A (HM FRAME) OR 1229B (WD FRAME) AS REQ'D	GREY	TRM

DOOR HARDWARE

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HARDWARE SET # 22 - STUDY, COMMUNITY, ENTREPRENEURSHIP CTR, OFFICE (30710/WDXHM)

DOOR(S): 209, 210, 211, 212, 213, 214, 313, 314, 315, 316, 317, 318, 319, 320, 321, 323a, 323b, 324a, 324b, 325, 326, 327, 328, 329a, 329b, 329c, 331a

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB179 4.5 X 4.5 NRP	652	STN
1	EA	LOCKSET	45H7A14J CORMAX (OFFICE/ENTRY)	626	BST
1	EA	FLOOR STOP	1215 CKU	626	TRM
1	EA	SILENCER	1229A (HM FRAME) OR 1229B (WD FRAME) AS REQ'D	GREY	TRM

HARDWARE SET # 23 - STUDENT LOUNGE ENTRANCE (3080/ALXAL)

DOOR(S): 216f, 216g

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
1	EA	CONTINUOUS HGE	661HD X LAR	AL	STN
1	EA	RIM EXIT DEVICE	3RO 2403 CD X 2903D (STOREROOM)	626W	PHI
1	EA	CYLINDER	12E-72 CORMAX (RIM) (ED TRIM)	626	BST
1	EA	CYLINDER	1E-74 CORMAX (MORTISE) (CYLINDER DOGGING)	626	BST
1	EA	CLOSER	CLD-4550 SN (MOUNT PARALLEL ARM - PUSH SIDE)	689	SDC
1	SET	SPACERS/BRKTS	CLOSER DROP PLATE/SPACERS AND BRACKETS AS REQUIRED FOR SECURE INSTALLATION	689	SDC
1	EA	FLOOR STOP	1215 CKU	626	TRM
1	EA	SWEEP	601 A X LAR	AL	NGP
1	EA	THRESHOLD	425 X LAR X FASTENERS FOR SECURE ATTACHMENT TO SUBSTRATE	AL	NGP

NOTE (S):

BALANCE OF ALL WEATHERSEALS BY DOOR
SUPPLIER

HARDWARE SET # 24 - ELECTRICAL (30710/WDXHM/UL)

DOOR(S): 307

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB179 4.5 X 4.5	652	STN
1	EA	LOCKSET	45H7D14J CORMAX (STOREROOM)	626	BST
1	EA	CLOSER	CLD-4550 SN (MOUNT REGULAR ARM - PULL SIDE)	689	SDC
1	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
1	EA	FLOOR STOP	1215 CKU	626	TRM
3	EA	SILENCER	1229A (HM FRAME) OR 1229B (WD FRAME) AS REQ'D	GREY	TRM

HARDWARE SET # 25 - OUTDOOR TERRACE (30710/ALXAL)

DOOR(S): 304c, 329d, 331b

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
1	EA	CONTINUOUS HGE	661HD X LAR	AL	STN
1	EA	DEADLOCK	MS1850S	628	ADM
1	EA	TT CYLINDER	1EA-7A4	626	BST
1	EA	CYLINDER	1E-74 CORMAX X CAM REQ'D (MORTISE)	626	BST
1	EA	PUSH/PULL BAR	1737 X LAR	630	TRM
1	EA	CLOSER	CLD-4550 SN (MOUNT REGULAR ARM - PULL SIDE)	689	SDC
1	EA	FLOOR STOP	1215 CKU	626	TRM
1	EA	SWEEP	601 A X LAR	AL	NGP
1	EA	THRESHOLD	425 X LAR X FASTENERS FOR SECURE ATTACHMENT TO SUBSTRATE	AL	NGP

NOTE (S):

BALANCE OF ALL WEATHERSEALS BY DOOR SUPPLIER

HARDWARE SET # 26 - ROOF ACCESS (3050/HMXHM)

DOOR(S): 310

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
2	EA	HINGE	FBB191 4.5 X 4.5	630	STN
1	EA	LOCKSET	45H7D14J CORMAX (STOREROOM)	626	BST
1	EA	FLOOR STOP	1215 CKU	626	TRM
1	EA	SEAL	5050C X LAR (HEAD/JAMBS)	BLK	NGP
1	EA	SWEEP	601 A X LAR	AL	NGP
1	EA	THRESHOLD	425 X LAR X FASTENERS FOR SECURE ATTACHMENT TO SUBSTRATE	AL	NGP
1	EA	DRIP CAP	16A X OFW	AL	NGP

HARDWARE SET # 27 - TOILET (30710/WDXHM)

DOOR(S): 108c, 130a, 335, 336

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB179 4.5 X 4.5	652	STN
1	EA	LATCHSET	45H0L14J VIN (PRIVACY W/INDICATOR)	626	BST
1	EA	FLOOR STOP	1215 CKU	626	TRM
3	EA	SILENCER	1229A (HM FRAME) OR 1229B (WD FRAME) AS REQ'D	GREY	TRM

HARDWARE SET # 28 – NOT USED

HARDWARE SET # 29 - OUTDOOR TERRACE, ROOF PENTHSE MECHANICAL ACCESS (3079/HMXHM/UL)

DOOR(S): 340c, 401, 402, 403

EACH TO HAVE:

<u>QTY</u>	<u>UNIT</u>	<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFG</u>
4	EA	HINGE	FBB199 4.5 X 4.5 NRP	630	STN
1	EA	LOCKSET	45H7D14J CORMAX (STOREROOM) (PENTHOUSE SIDE IS SECURE SIDE)	626	BST
1	EA	CLOSER	CLD-4550 SN (MOUNT REGULAR ARM - PULL SIDE)	689	SDC
1	EA	PROTECTION PLT	KO050 8" X 2" LDW X B4E/CSK (KICK-PUSH)	630	TRM
1	EA	SEAL	5050C X LAR (HEAD/JAMBS)	BLK	NGP
1	EA	HD FLOOR STOP	1209 (MOUNT AT MAX SWING OF CLOSER)	630	TRM
1	EA	SWEEP	601 A X LAR	AL	NGP
1	EA	THRESHOLD	425 X LAR X FASTENERS FOR SECURE ATTACHMENT TO SUBSTRATE	AL	NGP
1	EA	DRIP CAP	16A X OFW	AL	NGP

END OF SECTION

SECTION 08.800 GLAZING

PART 1 GENERAL

1.01 SUMMARY

- A. Types of work in this section include glass and glazing for:
 - 1. Fixed Glass Units and Doors
 - 2. Frameless Glass Walls
- B. Related Sections include the following:
 - 1. Division 8 Section "Flush Wood Doors"
 - 2. Division 8 Section "Steel Doors and Frames"
 - 3. Division 8 Section "Aluminum Entrances, Curtainwall and Storefronts"

1.02 SUBMITTALS

- A. Samples: Submit 12-inch square samples of each type of glass indicated, and 12 inch long samples of each color required (except black) for each type of sealant or gasket exposed to view.
- B. Compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants and other glazing materials.
- C. Product Certificates: Obtain Certificate of Compliance for all glass products

1.03 QUALITY ASSURANCE

- A. Design Requirements
 - 1. Refer to Structural Drawings for pressures required.
- B. Safety glass products are to comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.
 - 1. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.
- C. Insulating glass products are to be permanently marked either on spacers or at least one component lite of units with appropriate certification label of inspecting and testing agency indicated below:
 - 1. Insulating Glass Certification Council (IGCC).
- D. Single Source fabrication responsibility: Fabrication processes, insulating, laminating,

silkscreen, and tempering, shall be fabricated by a single Fabricator.

- E. Protect glass from edge damage during handling and installation, and subsequent operation of glazing components of the work. During installation, discard units with significant edge damage or other imperfections.
- F. Comply with combined recommendations and technical reports by manufacturers of glass and glazing products as used in each glazing channel, and with recommendations of Flat Glass Marketing Association "Glazing Manual", except where more stringent requirements are indicated.

1.04 WARRANTY

- A. Warranty on Hermetic Seals: Provide insulating glass manufacturer's written warranty, agreeing to, within specified warranty period, furnish FOB project site, replacement units for insulating glass units which have defective hermetic seals (excluding that due to glass breakage); defined to include intrusion of moisture or dirt, internal condensation at temperatures above -20 degrees F (-31 degrees C), deterioration of internal glass coatings, and other visual evidence of seal failure or performance failure. Warranty period is 5 years after seal date permanently imprinted on unit, but not less than 5 years after date of substantial completion of Project.
- B. The Contractor shall guarantee to the Owner that the installed storefront systems and glass panels meet all local code wind conditions for 130 mile an hour wind, and that the entire system shall remain free of water leaks for a period of one year from the date of final acceptance.
- C. Any leaks or defective work shall be immediately corrected by the manufacturer and Contractor, at no expense to the Owner.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 2190, Class CBA.

1. Overall Unit Thickness and Thickness of Each Lite:
Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
- B. Basis of Design on insulating units:
 1. Performance Values:
 - a. Visible Light Transmission %: 51/62
 - b. UV Transmission %: 4
 - c. Visible Light Out Reflectivity %: 8
 - d. Visible Light Reflectivity inside %: 11
 - e. U-Value Winter Nighttime: 0.29
 - f. U-Value Summer Daytime: 0.27
 - g. Shading Coefficient: 0.29
 - h. Solar Heat Gain Coefficient: 0.25
 - i. Light-to-Solar Gain: 2.0

2.02 FABRICATION

- A. Provide in overall sizes indicated on Drawings and as specified herein.
- B. TISG (Low-E Insulated Glass) 1":
 1. To be installed in all openings over 60" above adjacent floor
 2. 1/4" Heat Strengthened fully tempered Outboard/Exterior Lite
 3. 1/2" Air Space
 4. 1/4" clear float glass Inboard Lite
- C. TISG (Low-E Insulated Safety Glass) 1":
 1. To be installed in all openings below 60" above adjacent floor.
 2. 1/4" Heat Strengthened fully tempered Outboard/Exterior Lite
 3. 1/2" Air Space
 4. 1/4" Heat Strengthened fully tempered Inboard Lite
- D. CSG (Clear Safety Glass) 1/4":
 1. 1/4 inch thick clear fully tempered glass.
- E. OSG (Obscured Safety Glass) 1/4":
 1. 1/4 inch thick frosted fully tempered glass.
- F. PSG (Clear Safety Glass w/ Polished Edge) 3/4":
 1. 3/4 inch thick clear fully tempered glass with polished top edge at railings. Refer to Division 5 Section (Metal Fabrications) for additional information on railing system.
- G. FSG (Fire Safety Glass - Laminated Ceramic) 5/16":
 1. Proprietary Category II safety glazing product in the form of 2 lites of clear ceramic glazing material laminated together to produce a laminated

lite of 5/16 inch nominal thickness; polished on both surfaces; weighing 4 lb/sq. ft.; and as follows:

- a. Product: "FireLite Plus" by Nippon Electric Glass Co., Ltd., and distributed by Technical Glass Products.
 - b. Wire glass is not acceptable.
- H. SISG (Spandrel Insulated Safety Glass) 1":
1. 1/4" Heat Strengthened fully tempered tinted Outboard/Exterior Lite
 2. 1/2" Air Space
 3. 1/4" Heat Strengthened fully tempered frosted Inboard Lite.
- I. Frameless Glass Walls equal to CRL Cascade Frameless Glass Wall Office System by C.R. Laurence, U.S. Aluminum. Fixed glass panels, height as indicated on the drawings (floor to ceiling) with 1/2" tempered glass (obscured where indicated) and high quality polycarbonate dry joints that are 93% clear and resist fading and shrinkage when exposed to U.V.

2.03 COMPONENTS

- A. General: Provide color of exposed sealant/compound indicated or if not otherwise indicated, as selected by Architect from manufacturer's standard colors, or black if no color is so selected. Comply with manufacturer's recommendations for selection of hardness, depending upon the location of each application, conditions at time of installation, and performance requirements as indicated. Select materials and variations or modifications carefully for compatibility with surfaces contacted in the installation. Sealants shall contain no asbestos.
- B. 2-part Polysulfide Glazing Sealant: Elastomeric polysulfide sealant complying with FS TT-S-227, Class A, Type 2; specially compounded and tested to show a minimum of 20 years resistance to deterioration in normal glazing applications. Use for all exterior locations. Verify compatibility with insulating glass and substitute if necessary.
- C. Oleo-resinous Glazing Compound: Oil-based glazing compound; non-staining and non-bleeding; provide proper type as required for channel. Use for interior locations.

2.04 ACCESSORIES

A. Miscellaneous Materials

1. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
2. Setting Blocks: Neoprene or EPDM, 79-90 durometer hardness, with proven compatibility with sealants used.
3. Spacers: Neoprene or EPDM, 40-50 durometer hardness with proven compatibility with sealants used.
4. Compressible Filler (Rod): Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with sealants used; flexible and resilient, with 5-10 psi compressive strength for 25% deflection.

B. Structural Sealant

1. Structural Sealant: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant.
 - a. Provide sealants for use inside that have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Color: Black.

2.05 FRAMELESS GLASS DOORS AND PANELS

1. Provide system equal to C.R. Laurence Company "CRL Patch Door Kit for Use with Overhead Door Closer - With Lock, model #PHA2LA"
 - a. Top and Bottom Door Patches shall accept 1/2 inch tempered glazing as specified herein.
 - b. Provide with locks, cylinder to be furnished under Division 8 Section "Door Hardware".
 - c. Furnish all accessories for a complete installation including but not limited to locks, pivots, closer inserts, and end caps.
 - d. Top pivots to attach to aluminum storefront frame, prep frame accordingly for concealed installation.
 - e. Top pivots to attach directly to existing concrete floor slab. Coordinate any necessary recess of existing concrete slab and/or block out resinous floor to provide concealed installation.
 - f. Finish: Satin Anodized

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean glazing channel and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrate. Remove lacquer from metal surfaces where elastomeric sealants are used.
- B. Apply primer or sealant to joint surfaces where recommended by sealant manufacturer.

3.02 INSTALLATION

A. General

- 1. Watertight and airtight installation of each glass product is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, and impact loading (for doors), without failure, including loss or breakage of glass, failure of sealants to remain watertight and airtight, deterioration of glazing materials and other defects in the work.
- 2. Install insulating glass units to comply with recommendations by Sealed Insulating Glass Manufacturers' Association, except as otherwise specifically indicated or recommended by glass and sealant manufacturers.

B. Glazing

- 1. Install setting blocks of proper size in sill rabbet located in 1/4 of glass width from each corner. Set blocks in thin course of heel-bead compound, if any.
- 2. Provide spacers inside and out, of proper size and spacing, for glass sizes larger than 50 united inches, except where preshimmed tapes are used for glazing. Provide 1/8" minimum bite of spacers on glass and use thickness equal to sealant width.
- 3. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
- 4. Voids and Filler Rods: Prevent exudation of sealant or compound by forming voids or installing filler rods in channel at heel of jambs and head (do not leave voids in sill channels), except as otherwise indicated and depending on light size, thickness and type of glass and complying with manufacturer's recommendations.

5. Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
6. Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from glass.
7. Clean and trim excess glazing materials from glass and stops or frames promptly after installation, and eliminate stains and discolorations.
8. Factory glazing may deviate from these specifications as necessary to accommodate manufacturer's standard glazing procedures which will result in a watertight, rattle free installation.

3.03 CLEANING

- A. Wash and polish glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of Substantial Completion of project. Comply with glass product manufacturer's recommendations for final cleaning.
- B. Remove and recycle excess material.
 1. Separate float glass and place in designated areas for reuse or recycling (cannot be recycled with beverage-container glass).
 2. Separate plastic materials and place in designated areas for reuse or recycling.
 3. Separate corrugated cardboard and place in designated areas for recycling.

3.04 PROTECTION

- A. Protect exterior glass from breakage. Do not apply markers to surfaces of glass. Remove non-permanent labels and clean surfaces. Cure sealant for high early strength and durability.
- B. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.

END OF SECTION

SECTION 08.830 UNFRAMED MIRRORS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Unframed mirrors in the Restrooms as shown on drawings.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Mirrors: 1/4" thick mirror glazing polished plate glass with backs silvered. Size as indicated on the drawings. New mirrors shall be guaranteed against silver spoilage for a period of five (5) years.
- B. Adhesive: Adhesive shall provide a strong bond between glass mirrors and substrate. Adhesive must be compatible with silver mirror backing paint; and must not cause silver deterioration. Strength of adhesive shall reach 300psi when fully cured.

PART 3 EXECUTION

3.01 INSPECTION

- A. Assure that units are centered over lavatories. All dimensions shall be field verified prior to fabrication. Refer to Drawings.
- B. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Apply one 2" to 2-1/2" diameter daub of adhesive, about 1" thick, per square foot of mirror. Daub should be large enough to compress to a 3-1/2" to 4" diameter size when mirror is set in place.
- B. Mount mirrors plumb and securely to walls; no exposed fasteners.
- C. Bottom of edge of reflecting surface shall be mounted no higher than 40" above finished floor, as indicated on the drawings.

3.03 CLEANING

- A. Final cleaning of all mirrors shall be performed by the General Contractor. Remove all stickers and decals.

END OF SECTION

UNFRAMED MIRRORS

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SECTION 08.973 GLASS CANOPY

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Functional design, structural engineering, custom fabrication, and site erection of glass canopy
- B. Related sections
 - 1. Section 05.120 Structural Steel: Steel framing to support canopy.

1.02 REFERENCES

- A. American National Standards Institute (ANSI): ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
- B. American Society of Civil Engineers (ASCE): ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. American Society for Testing and Materials (ASTM):
 - 1. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 2. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - 3. ASTM A276 - Stainless and Heat-Resisting Steel Bars and Shapes.
 - 4. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
 - 5. ASTM B248 - Wrought Copper and Copper Alloy Plate, Sheet, Strip, and Rolled Bar.
 - 6. ASTM B221 - Aluminum-Alloy Extruded Bar, rod, Wire, Shape, and Tube.
 - 7. ASTM C509 - Elastomeric Cellular Preformed Gasket and Sealing Material.
 - 8. ASTM C864 - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
 - 9. ASTM C920 - Elastomeric Joint Sealants.
 - 10. ASTM C1036 - Flat Glass.
 - 11. ASTM C1048 - Heat Treated Flat Glass, Kind HS, Kind FT, Coated and uncoated.
 - 12. ASTM C1115 - Dense Elastomeric Silicone Rubber Gaskets and Accessories.
 - 13. ASTM C1172 - Laminated Architectural Flat Glass.

- 14. ASTM C1281 - Preformed Tape Sealants for Glazing Applications.
- 15. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- 16. ASTM E331 - Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- 17. ASTM E1300 - Determining Load Resistance of Glass in Buildings.
- D. Consumer Product Safety Commission (CPSC): CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- E. Glass Association of North America (GANA): GANA - Glazing Manual.
- F. International Code Council (ICC): ICC IBC - International Building Code.

1.03 GLASS CANOPY DESCRIPTION

- A. Exterior glass canopy to be custom designed, engineered, detailed, factory fabricated, and site assembled and erected.
- B. Basic configuration: Flat shape to provide architectural appearance shown on Drawings.
- C. Dimensions: Glass canopy shall be nominal dimensions shown on Drawings. Minor variations to accommodate manufacturer's design and components are acceptable provided overall concept is maintained.
- D. Type of glass canopy: Metal framing with glass panels equal to Vision Series Glass Canopy by Architectural Canopies.

1.04 DESIGN AND PERFORMANCE CRITERIA

- A. Design Requirements
 - 1. Design Wind Load: 105 mph
 - 2. Seismic Design Category: B
- B. Design, size components, and install glass canopy in accordance with ASTM E1300 to withstand these loads without breakage, loss, failure of seals, product deterioration, and other defects.
 - 1. Dead and live loads: Determined by ASCE 7 and calculated in accordance with applicable codes.
 - 2. Seismic loads: System shall be designed and installed to comply with applicable seismic requirements for Project location and Seismic Design Category: B as defined by ICC/IBC.

3. Movement and deflection of structural support framing.
 4. Effects of applicable wind load acting inward and outward normal to plane of canopy in accordance with ASTM E330.
 5. Design for thermal loads and movement: including Ambient Temperature Range and Material Surfaces Range.
- C. Provide and install exterior gaskets, sealants, and other glazing accessories to resist water penetration. There shall be no penetration at 15 pounds/square foot test pressure and 5 gallons/hour/square foot water rate tested in accordance ASTM E331.

1.05 SUBMITTALS

- A. Submit in accordance with Section 01340 - Shop Drawing, Product Data and Samples
1. Product data for all proposed components, materials, products, and accessories.
 - a. For each type glass, provide maximum allowable stress in both horizontal and vertical directions.
 - b. Provide photographs or drawings for fittings and hardware.
 2. Shop drawings
 - a. Plans, elevations, and sections illustrating shape, configuration, and dimensions. For complex canopies provide perspectives, renderings, or models.
 - b. Illustrate method of assembly, installation, and glazing.
 - c. Provide details for support framing, reinforcement, connections, joints, anchors, and other fabrication and installation conditions.
 - d. Indicate required tolerances and coordination with adjacent elements and work of other trades.
 3. Calculations: Show compliance with performance criteria and applicable loads with stamp of Licensed Professional Engineer registered in the State of Mississippi.
 4. Samples
 - a. 12 by 12 inches minimum size for each type glass.

- b. 6 inches minimum length of metal support framing.
- c. 6 inches minimum length for structural silicone sealant, butt, resilient gasket, glazed joint.
- d. Metal finishes.
- e. Sealant colors.
- 5. Manufacturer's installation and maintenance instructions.
- 6. Certificates or test reports demonstrating components and methods have been successfully tested by an independent laboratory in the United States certifying that the proposed system has been tested and as defined by Paragraph 1.04.
- 7. Data showing compliance with manufacturer's and installer's qualifications specified in Paragraphs 1.6.A and 1.6.B. Provide descriptions, locations, photographs, references, and completion dates for previous projects.
- 8. Copies of warranties required by Paragraph 1.11 for review by Architect. Included with warranty shall be a letter certifying the proposed system will be manufactured from one source. Glass cannot be supplied by one manufacturer and hardware from another manufacturer to comply with this warranty. Letters signed by the subcontractors or installers for this section are not acceptable.

1.06 QUALITY ASSURANCE

- A. Single source responsibility: Design, structural engineering, and custom fabrication for glass canopy and supply of all components, materials, and products shall be sole responsibility of single manufacturer. Provision of products from numerous sources for site assembly without complete single source design and supply responsibility is not acceptable. Components to be fabricated or supplied by single source are:
 - 1. Support framing.
 - 2. Glass
 - 3. Connectors, fittings, anchors, and installation accessories.
 - 4. Gaskets, glazing tape, and sealants.
 - 5. All other components, products, and materials required for complete, functional glass canopy.
- B. Single installation responsibility: All components listed in Paragraph 1.06.A shall be installed by a single installer.

- C. Manufacturer qualifications: Company specializing in designing, engineering, and fabricating unique, custom designed, glass canopies, facades, entrances, storefronts, and other glazed structures. Glass cannot be supplied by one manufacturer and hardware from another manufacturer to comply with this warranty. Letters signed by the subcontractors or installers for this section are not acceptable.
 - 1. Experience: 7 years minimum successful experience providing glass structures.
 - 2. Previous projects: Successfully completed 10 minimum glass structures of scope, type, and size as proposed Project.
- D. Installer qualifications: Company experienced in erecting custom designed, glass canopies, facades, entrances, storefronts, and other glazed structures and acceptable to manufacturer for installing proposed structure.
 - 1. Experience: 3 years minimum successful experience erecting glass structures.
 - 2. Previous projects: Successfully completed 3 minimum glass structures of scope, type, and size as proposed Project.
- E. Design structural components and develop shop drawings under direct supervision of professional structural engineer experienced in design of glass structures. Calculations and shop drawings shall bear engineer's seal.
- F. Safety glazing: Comply with Consumer Product Safety Commission 16 CFR 1201, ANSI Z97.1, and other applicable safety requirements. Each piece of safety glazing shall be permanently labeled with appropriate marking.

1.07 PRODUCT HANDLING

- A. Protect glass and other components during delivery, storage, and handling in accordance with manufacturer's instructions. Prevent edging chipping and other damage.
- B. Do not store glass panels on site for extended time.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. During glazing, maintain 40 degrees F minimum temperature.

1.09 WARRANTIES

A. Provide under provisions of Section 01700 - Contract Closeout:

1. Manufacturer's 2 years warranty to cover design, fabrication, and materials against defects and failure to perform and remain watertight. Warranty to provide for replacement of defective components.
2. Glass warranties: 5 years warranty to cover replacement of laminated glass units in event of de-lamination, edge separation, and blemishes.
3. Installer's 5 years warranty to cover installation against defects and failure to perform and remain watertight. Warranty to provide for required repairs.

PART 2 PRODUCTS

2.01 ACCEPTABLE DESIGNER-MANUFACTURER

A. Glass canopy shall be designed and fabricated by MASA Architectural Canopies, Inc.

VISION SERIES GLASS CANOPY

Address: 21 Randolph Ave., Avenel, N.J. 07001

Phone: 732-453-6120 Fax: 732-453-6126

Website: www.architecturalcanopies.com

B. Requests to use design services and products of another manufacturer must be submitted in accordance with Section 01630 - Substitutions and Product Options.

2.02 GLASS

A. Laminated glass fabricated by bonding two or more glass panes with transparent, flexible interlayment material in accordance with ASTM C1172. Laminated glass shall meet requirements of ANSI Z97.1 and CPSC 16 CFR to qualify as safety glass.

B. Fabricate laminated glass for canopy components from either ASTM C1036 annealed, ASTM C1048 Kind HS heat strengthened, or ASTM C1048 Kind FT fully tempered glass as determined by manufacturer to accommodate Project design and performance requirements specified in Paragraph 1.04.

C. Color: Clear

D. Glass thickness: Determined by glass canopy manufacturer to accommodate Project design and performance requirements specified in Paragraph 1.04.

GLASS CANOPY

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- E. For glass panels to be installed with mechanical connectors and fittings, provide holes to receive bolts and fitting pins. Holes shall be drilled prior to tempering glass.

2.03 METAL SUPPORT FRAMING

- A. Framing sections: Provide metal framing to support glass canopy panels as detailed on Drawings and approved shop drawings.
- B. Material: Cold-formed from low carbon, hot dipped galvanized steel complying with ASTM A653 and finished with electrostatically applied powder paint coating.
- C. Material minimum thickness: As determined by manufacturer to meet performance requirements specified in Paragraph 1.04.
- D. Size, shape, and configuration: As designed by manufacturer to efficiently frame glass structure and meet design criteria specified in Paragraph 1.04.
- E. Corner joints: Mitered, welded, and finished smooth and flush with adjacent surfaces.
- F. Glazing beads: Cold formed metal applied from interior or exterior, and designed for snap-in installation.

2.04 TENSION TRUSS JOISTS

- A. Support glass canopy panels with tension trusses consisting of:
 - 1. Tension members: Stainless steel solid rods complying with ASTM A276 with brushed satin finish. Type diameter, tensile strength determined by manufacturer to meet design criteria specified in Paragraph 1.04.
 - 2. Hardware: Provide connectors, turnbuckles, studs, and other hardware as shown on approved shop drawings and as required for fabrication of tension joists.
 - 3. Tubing: Stainless steel complying with ASTM A269 with brushed satin finish.
 - 4. Fittings to join glass panels to tension trusses: Stainless steel complying with ASTM A276 with brushed satin finish.
- B. Placement: Truss joists shall be installed above and perpendicular to glass canopy panels.
- C. Truss configuration, dimensions, spacing, and component sizes: As designed by manufacturer and indicated on shop drawings to efficiently support

glass canopy and meet performance criteria specified in Paragraph 1.04.

2.05 FITTINGS

- A. Provide structurally engineered and independently tested fittings by an independent laboratory in the United States for connecting glass panels and fins together and for attachment to supporting substrates.
- B. Material: Stainless steel complying with ASTM A276, Type 316 with brushed satin finish.
- C. Types: Configuration, number of points, size, and spacing shall be determined by manufacturer and scheduled on shop drawings to accommodate project design and meet performance criteria specified in Paragraph 1.04. Ensure that fitting-induced stresses do not exceed glass strength.
- D. Providing fittings with countersunk stainless steel bolts, Delrin bushings, and resilient gaskets.

2.06 ACCESSORIES

- A. Provide glazing accessories, anchors, and fasteners of type recommended by canopy manufacturer and as required for complete, functional, weather tight installation.
- B. Anchorage devices: Clips, anchors, fasteners, and shims required for secure installation of glass canopy. Type, size, and spacing as recommended by canopy manufacturer.
- C. Cleaners and primers: Recommended by manufacturer to be compatible with substrate and glazing materials.
- D. Setting blocks: Neoprene or EPDM complying with ASTM C864.
- E. Edge blocks: Elastomeric material of hardness required to limit lateral movement of glass.
- F. Gaskets: Molded or extruded elastomeric type of profile and hardness required to maintain weather tight seal and complying with ASTM C509, ASTM C864, or ASTM C1115.
- G. Glazing tape: Preformed butyl compound, non-staining, non-migrating in contact with non-porous surfaces, coiled on release paper, complying with ASTM C1281.
- H. Glazing sealant: Chemically curing type complying with ASTM C920, compatible with materials and conditions, and capable of anticipated joint movement without watertight seal failure.

I. Contact structural sealant: High performance, two component, non-sag, neutral cure, ultraviolet resistant, silicone sealant designed for structural glazing and complying with ASTM C920.

2.07 CANOPY FABRICATION

- A. Insofar as possible, fit and assemble canopy in shop.
- B. Fabricate free of visual distortion and defects. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Arrange fasteners and attachments to ensure concealment from view.
- E. Fabricate to drain water entering joints, condensation, and migrating moisture occurring within unit.

PART 3 EXECUTION

3.01 COORDINATION

- A. Coordinate provision of glass canopy construction of support columns and framing. Ensure that provision is made for attachments and transfer of calculated loads. Provide all attachment items in sufficient time for installation. Ensure that blockouts, pockets, bearings, for glass canopy components are provided, accurately placed and properly sized.
- B. Coordinate provision of glass canopy with related construction to ensure that canopy to building connections are waterproof.
- C. Field verify dimensions prior to fabricating glass canopy components.

3.02 INSPECTION

- A. Prior to delivery of glass panels to site, verify that support framing and substrates are ready to receive glass canopy. Verify alignment, dimensions, and tolerances are correct.
- B. Report unacceptable conditions and deficiencies. Do not proceed with installation until corrective action has been performed.
- C. Inspect glass panels for chipped edges, scratches, abrasions, and other damage.

- 3.03 GENERAL INSTALLATION
- A. Site assemble and erect glass canopy in accordance with approved shop drawings, manufacturer's installation instructions, and GANA Glazing Manual.
 - B. Damaged glass: Do not install glass with edge damage or other imperfections. Remove from site and replace.
 - C. Allow for settling, expanding, and contracting to occur without breaking glass.
 - D. Do not field cut or alter structural framing without written approval from manufacturer and Architect.
- 3.04 METAL FRAMING
- A. Use anchorage devices to securely attach metal framing to support structure and to accommodate construction tolerances and irregularities.
 - B. Insulate dissimilar metals to prevent electrolysis and other forms of corrosion with bituminous paint or non-absorptive gasket to prevent contact.
 - C. Align framing plumb, level, and free of warp or twist.
- 3.05 GLAZING
- A. Protect adjacent surfaces sealants and glazing materials with masking tape or other means.
 - B. Install setting blocks and spacers as recommended by canopy manufacturer and indicated on approved shop drawings.
 - 1. Place setting blocks at quarter points. Maintain 6 inches space from corners.
 - 2. Set blocks in sealant.
 - C. Provide edge blocking as required to prevent sideways movement of glass in glazing channel.
 - D. Ensure glazing channels and stops provide required bite on glass, minimum edge and face clearances, and adequate sealant thickness.
 - E. Glazing methods: Type as determined by manufacturer and indicated on approved shop drawings.
 - 1. Tape glazing
 - a. Cut glazing tape to length and set continuously against permanent stops and projecting slightly above sight line.
 - b. Tape joints: Butt joints. Do not overlap tape. Seal joints with compatible sealant.
 - c. Rest glass on setting blocks and push against tape for full contact at perimeter of lite.
 - d. Remove tape release paper immediately prior to placing glass.

- e. Install compressible gasket against glass and secure with removable glazing stop.
 - f. Knife trim protruding edge of glazing tape.
2. Gasket glazing
- a. Fabricate two piece compression gaskets to exactly fit openings.
 - b. Install soft compression gasket against permanent stops. Miter cut and bond together corners.
 - c. Rest glass on setting blocks. Insert dense compression gasket to press glass against soft gasket and lock in place against removable stop.
 - d. Apply sealant to gasket joints.
 - e. Install gaskets to protrude slightly beyond glazing stops.
3. Wet sealant glazing
- a. Install spacers and sealant backing between glass and stops. Position to control depth and width of sealant.
 - b. Apply sealant to glazing channels without voids. Ensure complete bond of sealant to glass and channel surfaces.
 - c. Tool exposed sealant surfaces to provide wash away from glass.
4. Structural silicone glazing
- a. Cleaning: Thoroughly clean all joints and glazing areas immediately prior to sealant application. Remove oil, dust, grease, water, surface dirt, contaminants, and other foreign matter. Vacuum or blow out dust and loose particles from joints. Do not use water cleaning treatments.
 - b. Use primers only as recommended by sealant manufacturer. Field test with and without primer before actual application.
 - c. Mask areas adjacent to joints to insure neat sealant line. Do not allow tape to touch surfaces to which sealant will be applied.
 - d. Install sealant back-up spacers as indicated on Drawings and approved shop drawings.
 - e. Apply silicone structural sealant in continuous operation. Tool sealant immediately before skin forms. Tool concave to ensure complete contact.
 - f. Post application test: After structural sealant has cured 14 to 21 days, conduct field

test as prescribed by manufacturer to test sealant adhesion. Replace sealant not passing test.

3.06 MECHANICAL ASSEMBLED GLASS UNITS

- A. Mechanically install glass canopy panels with stainless steel fittings as designed by manufacturer and indicated on approved shop drawings.
- B. Tension trusses: Tension truss joists shall be mechanically joined to glass panels to provide structural support.
- C. Glass panels shall be mechanically attached directly to supporting substrate with fittings and anchors.
- D. Secure glass panels to fittings with bolts. Torque bolt to amount specified on approved shop drawings using calibrated tool. Lock torqued bolt into position to prevent backoff. Reset calibrations regularly to ensure accurate torquing.

3.07 CLEANING

- A. Clean excess sealant from glass and other surfaces immediately after application. Use solvents or other cleaners recommended by manufacturer.
- B. Remove protective material from prefinished surfaces.
- C. Wash exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean cloths. Do not use abrasives. Take care to remove dirt from corners. Wipe surfaces clean.

END OF SECTION

SECTION 09.100 METAL SUPPORT ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Interior framing systems (includes but is not limited to supports for partition walls, shafts, framed soffits, furring).
2. Interior suspension systems (includes but is not limited to supports for ceilings, suspended soffits).

B. Related Sections include the following:

1. Division 5 Section "Exterior Steel Stud System"
2. Division 6 Section "Rough Carpentry"
3. Division 9 Section "Gypsum Board Assemblies"

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

1.03 QUALITY ASSURANCE

A. Direct Suspension Systems: ASTM C635

B. Metal Support System Installation: ASTM C754

C. Allowable Tolerances: 1/8" in 8' -0" variation in finish surface

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and in a manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

PART 2 PRODUCTS

2.01 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating, unless otherwise indicated.

2.02

SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch diameter wire, or double strand of 0.0475-inch diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - a. Type: Postinstalled, expansion anchor.
 - b. Powder-Actuated Fastener (Option): Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch wide flanges.
 - 1. Depth: 2 inches unless otherwise noted on Drawings.
- E. Furring Channels (Furring Members):
 - 1. Steel Studs: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 20 gauge, unless otherwise indicated on Drawings.
 - b. Depth: 3-5/8 inches unless otherwise indicated on Drawings.
- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - 2. Chicago Metallic Corporation; 650-C Drywall Furring System.
 - 3. USG Corporation; Drywall Suspension System.

2.03

STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
 - 1. Double 20 gage stud framing at all openings including door and view panels.

2. 20 gauge at 16" o.c. for tile backer board locations
 3. 22 gauge at 16" o.c. for other locations.
 4. Use 18 gauge for all runners.
- B. Slip-Type Head Joints: Where indicated or at a minimum where required by the Steel Stud Manufacturers Association (SSMA), provide the following:
1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- C. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base Metal Thickness: 25 gauge
 2. Depth: 1-1/2 inches unless otherwise noted.
- D. Horizontal bracing shall be 1-1/2" cold rolled channels secured with screw attached 1-1/2" x 2" x 16 gauge clip angles. Cut to length 1/4" less than width.

2.04 SHAFTLINER SUPPORTS

- A. Conform to ASTM A446, Grade A, with G40 hot-dipped galvanized coating per ASTM A525.
- B. Studs
1. Shape: "C-H" or as standard with manufacturer.
 2. Gauge: As required to fulfill performance criteria, minimum 25 gauge. Provide 20 gauge for jamb and lintel components.
 3. Size: As indicated.
 4. J runners: 24 gauge, size as required for coordination with studs.
 5. Jamb struts: 20 gauge with 3 inch back leg where required (at door frames).

2.05 STEEL FRAMING ACCESSORIES

- A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

- B. Provide stud manufacturer's standard clips, shoes, ties, reinforcement, and other accessories as needed for a complete partition framing system.

2.06 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. For fire rated construction, use same fasteners as used in applicable fire test.

PART 3 EXECUTION

3.01 INSTALLATION

A. Metal Support Systems

- 1. Direct-hung Suspension System: Attach perimeter support member to adjacent vertical surfaces. Mechanically join support members to each other and butt-cut to fit into wall support. Cut, bend and secure joints at bulkhead at ceiling level change as indicated and in accordance with manufacturer's recommendations.
 - a. Space runners 48 inches on center, and suspend from structure with specified hangers spaced no more than 48 inches on center along the runners.
 - (1) For interior ceilings suspend from structure with 12 gage or heavier galvanized steel wire. Wrap ties tightly at least 3 full turns.
 - b. Place furring tees 16 inches on center between furring runners. Provide a furring tee at, and 8 inches each side of, gypsum board end joints.
 - c. Provide auxiliary framing at openings for light fixtures and similar work, as required for support of both the gypsum board and other work indicated for support thereon.
 - d. Install supplementary framing, runners, blocking and bracing at openings and terminations in the work, and at locations required to support fixtures, equipment, services, heavy trim, grab bars, toilet accessories, furnishings, and similar work which cannot be adequately supported on gypsum board alone.

2. Wall/Partition Support System: Support systems shall extend from floor to heights indicated on partition types/schedule.
 - a. Install runner tracks at floors and bottom of roof or floor framing members and where stud system abuts other construction. Where partitions parallel, but are not directly beneath framing members, where there is no floor above, provide runner, or stud, headers between beams, spaced 4 feet on center, attached at each end, and secure top runner of partition thereto.
 - b. Space studs 16 inches on center, unless otherwise indicated.
 - c. Frame door openings with 20 gage vertical studs. Provide runner track header of same gage as jamb studs, and jack studs same as partition studs across head of opening.
 - d. Frame other openings same as door openings and frame above and below openings same as above door head.
 - e. Install supplementary framing, runners, blocking and bracing at openings and terminations in the work, and at locations required to support fixtures, equipment, services, heavy trim and similar work which cannot be adequately supported on gypsum board alone.
 - f. Secure perimeter framing to structural elements with suitable fasteners located 2 inches from each end and 24 inches apart between, except top runner parallel to, but not directly under, framing members will be attached with 2 screws to headers provided at 48 inches on center. Anchor studs adjacent to door and fixed light openings, partition intersections, and corners to top and bottom runner flanges. Make web-flange bend at each end of runner over openings and screw to jamb studs with 2 screws each end.
 - g. Install horizontal bracing in all stud walls, not to exceed 5'-0" on center vertically. Insert channels through stud web holes and secure with screw attached clip angles at each stud. Horizontal bracing shall prevent stud rotation.

3. Shaftliner Installation
 - a. Provide slip or cushioned joints to isolate shaftwall system. Comply with manufacturer's instructions.
 - b. Seal joints and penetrations on both sides of shaftwall system.
4. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

END OF SECTION

SECTION 09.200 LATH AND PLASTER

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Drawings and general provisions of contract, including General & Supplementary Conditions and other Division 1 specification sections, apply to this section.

1.02 DESCRIPTION OF WORK

A. The types of work include the following:
1. Metal furring and lathing
2. Gypsum plastering

1.03 QUALITY ASSURANCE

A. Interior Lathing and Furring Installation Standards: ASTM C 841.
B. Interior Gypsum Plaster Application Standard: ASTC C 842.
C. Allowable Tolerances: For flat surfaces, do not exceed 1/8" in 8'-0" for bow or warp of surface, and for plumb or level.

1.04 PRODUCT HANDLING

A. Deliver, store, and protect manufactured materials to comply with referenced standards.

1.05 JOB CONDITIONS

A. Comply with referenced standards for environmental conditions. Protect contiguous work from soiling, spattering, moisture deterioration and other harmful effects which might result from plastering.

PART 2 PRODUCTS

2.01 METAL LATHING MATERIALS

A. Where not otherwise indicated, comply with MLSFA "Technical Bulletin 101" and ASTM C 841 for selection of metal lath for each application indicated. Comply with FS QQ-L-101. Where lath is indicated to have backing, and where backing is required for machine application of plaster, provide lath with factory-applied backing of moisture-resistant paper or polyethylene film.

B. Interior Diamond Lath: 3.4 lbs. per square yard, std. mesh.

2.02 METAL PLASTERING ACCESSORIES AND REINFORCEMENT

- A. Coordinate depth of accessory with thickness of and number of coats of plaster to be applied.
- B. Small-Nose Corner Beads: General purpose type with expanded or perforated flanges.
- C. Cornerite: Manufacturer's standard preformed interior corner reinforcement made from 2.5 lb. per sq. yd. diamond mesh lath.
- D. Square-Edged Casing Beads: Manufacturer's standard; with expanded or short flange to suit application.
- E. Two-Piece Control Joints: Manufacturer's standard roll-formed pair of casing beads with modified back flanges providing positive slip joint action and dust barrier, adjustable for joint width variation of 1/8" to 5/8".
- F. Corner Reinforcement: Special stucco-type woven galvanized wire corner reinforcing strips.
- G. Line Wire: 18 gauge soft annealed steel wire.
- H. Fasteners: Galvanized steel, of type and length suitable for adequate penetration of the substrate.
- I. Soffit Vent: Where indicated on drawings, soffit vent #VS-3430 as manufactured by Gordon, Inc., aluminum 3" wide, with clear anodized finish.

2.03 GYPSUM PLASTER MATERIALS

- A. Provide either neat or ready-mixed (where applicable) materials at Installer's option, unless otherwise indicated.
- B. Base Coat Plaster: High strength gypsum, with 2800 psi compressive strength for a 100 lb. per 2 cu. ft. plaster sand mix.
- C. Base Coat Aggregate: Sand.
- D. Finish Coat Plaster: Gypsum gauging plaster.
- E. Finishing Lime: Special finishing hydrated lime (Type S).
- F. Plaster Bond: Equal to Plaster-Weld, Larsen Products Corp.

PART 3 EXECUTION

3.01 PREPARATION

- A. Plastering: Clear plaster bases and substrates to be plastered removing loose materials, coatings and other substrates which might impair the work.

- 3.02 METAL LATHING
- A. Install metal lath to comply with referenced standards unless otherwise indicated.
- 3.03 PLASTERING ACCESSORIES
- A. Anchor each flange of accessories 8" o.c. to plaster base. Miter or cope accessory corners, and install with tight joints accurately aligned. Set accessories plumb, level, and true to line, with a tolerance of 1/8" in 10'-0".
- B. Install metal corner beads at external corners.
- C. Install casing beads at terminations of plaster work, except where plaster is indicated to pass through other work and be concealed by lapping work, and except where special screens, bases, or frames act as casing beads 1/4" from abutting frames and other work (for application of sealant).
- D. Where plaster abuts concrete, set casing bead 1/4" from concrete.
- E. At control joints and expansion joints set pair of casing beads back to back, with metal strip behind anchored to only one side of joint. At expansion joint space beads 1/4" apart for interior work, 3/8" apart for exterior.
- 3.04 INSTALLATION OF PLASTER
- A. Mechanically mix plaster materials at the project site; do not hand mix except where small amounts are needed, using less than one bag of plaster. Sequence plaster installation properly with the installation and protection of other work so that neither will be damaged by the installation of the other.
- B. Plaster flush with metal frames and other built-in metal items or accessories which act as a plaster ground, unless otherwise shown. Where plaster is not terminated at metal by casing beads, cut base-coat free from metal before plaster sets and groove finish coat at the junctures with metal.
- C. Apply thicknesses and number of coats of plaster as indicated; or as required by referenced standards. Provide 3-coat plaster installation.
- D. Texture of Plaster Finishes: Except as otherwise indicated, apply finish coat as follows. Gypsum Plaster: Match existing texture.

3.05 PATCHING

- A. Point up around trim at removed partitions, windows and doors, and other work. Cut out and patch defective or damaged new plaster required by this section. Finish patching plaster smooth and flush with adjoining work. Match existing work in texture and finish.
- B. Cut out and replace and/or patch all defective plaster work presently in building. Remove sufficient amount of plaster at cracks and other defective areas to assure a proper bond of the new work. Finish restored areas to produce a smooth uniform finish. Skim coating particularly problematic wall to corners may be required.
- C. Condition and repair existing plaster work to remain to effect proper restoration.
- D. Use "Plaster-Weld" as plaster bond in patch of existing plaster, follow manufacturer's recommendations.

3.06 CLEANING AND PROTECTION

- A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces which have been stained, marred or otherwise damaged during the plastering work. When plastering work is completed, remove unused materials, containers and equipment and clean floors of plaster debris.
- B. Installer shall advise the Contractor of requirements for the protection of plaster from deterioration and damage during the remainder of the construction period.

3.07 WASTE MANAGEMENT

- A. Separate metal waste in accordance with the Waste Management Plan and place in designated areas for recycling or reuse.
- B. Separate plaster and cement waste in accordance with the Waste Management Plan and place in designated areas for recycling, reuse, or proper disposal.

END OF SECTION

LATH AND PLASTER

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SECTION 09.206 STUCCO WORK

PART 1 GENERAL

- 1.01 RELATED DOCUMENTS: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this and all sections.
- 1.02 DESCRIPTION OF WORK
- A. Types of work include: Three Coat Stucco System with plastic veneer finish.
 - B. For buildings work includes the following:
 - 1. Metal lath installed over wall underlayment and sheathing and attached to metal studs, or furring channels, with a three coat stucco system with the finish coat being "Exterior Elastomeric Waterproofing System". Overall thickness to be 3/4" - 7/8".
- 1.03 QUALITY ASSURANCE
- A. Portland Cement Plastering Standards: ANSI A 42.2 and A 42.3.
 - B. Allowable Tolerances: For flat surfaces, do not exceed 1/8 inch in 8 feet for bow or warp of surfaces, and for plumb or level.
 - C. Comply with ASTM C1063.
- 1.04 SUBMITTALS
- A. Product Data: Submit manufacturer's product specifications and installation instructions for each material, including other data as may be required to show compliance with these specifications.
- 1.05 PRODUCT HANDLING
- A. Manufactured materials shall be delivered in their original packages, bearing the name of the manufacturer and the brand name. Materials shall be stored off the ground in a building away from sweating walls and other damp surfaces. Damaged or deteriorated material shall not be used.

1.06 JOB CONDITIONS

- A. Protect contiguous work from soiling, spattering, moisture deterioration and other harmful effects which might result from plastering.

PART 2 PRODUCTS

2.01 METAL SUPPORT, FURRING, LATHING AND ACCESSORY MATERIALS

A. General

- 1. Metals and Finishes: Manufacturer's standard steel products unless indicated as zinc alloy or other material. Where not otherwise indicated, provide manufacturer's standard galvanized finish on steel products, except as follows:
 - a. Exterior Plastering Accessories (not indicated as plastic or aluminum): Zinc Alloy.

B. Wire Ties: Galvanized soft steel wire.

C. Metal Lathing Materials

- 1. Exterior Lath: 3.4 lb. per sq. yd., self-furring diamond mesh, galvanized.

D. Metal furring (hot) channels: 7/8" high metal furring channels by U.S.G.

E. Metal Plastering Accessories and Reinforcement:

- 1. General: Coordinate depth of accessory with thickness of, and number of coats of, plaster to be applied. (1")
 - a. Small-nose Corner Beads: General purpose type with expanded or perforated flanges. (No. 1A)
 - b. Stops to No. 66.
 - c. Cornerite: Manufacturer's standard preformed interior corner reinforcement.
 - d. Square-edged Casing Beads: Manufacturer's standard with expanded or short flange to suit conditions.
 - e. Control Joint: Manufacturer's standard two piece joint consisting of a pair of casing beads with modified back flanges providing positive slip joint action and dust barrier.
 - f. Fasteners: Galvanized steel, of type and length suitable for adequate penetration of the substrate.

F. Underlayment behind Stucco: Grade D Building paper equal to DuPont Tyvek StuccoWrap.

G. Optional Stucco Accessories

- 1. At Contractor's option plastic accessories of equivalent design may be used for exterior plaster in lieu of the zinc alloy material specified.

Accessories shall be VinylTech as manufactured by Plastic Components, Inc., Miami, Florida or equal.

2.02 PORTLAND CEMENT PLASTER MATERIALS

- A. General: Provide either neat or ready-mixed (where applicable) materials, at installer's option, complying with ANSI A42.2.
- B. Base Coat Cement: Portland Cement, ASTM C 150, Type 1 or 1A.
- C. Mortar Mix: M.M.M., Longview, Ideal or approved equal.
- D. Base Coat Lime: Special Finishing Hydrated Lime, Type S.
- E. Base Coat Aggregate: Clean, washed, sharp sand conforming to ASTM C-35.

Sieve Analysis of Sand (ASA-A42.2)

<u>Sieve Size</u>	<u>Minimum</u>	<u>Maximum</u>
No. 4	-	0
No. 8	0	10
No. 16	10	40
No. 30	30	65
No. 50	70	90
No. 100	95	100

(Percentage retained on each sieve by weight)

- F. Base Coat Fiber: Hair or fiber; mixed with plaster for scratch coat on metal lath.
- G. Finish Coat: Exterior elastomeric waterproofing system equal to Loxon XP by Sherwin-Williams (CUSTOM COLOR AS SELECTED BY THE ARCHITECT), or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION OF METAL SUPPORT SYSTEM

A. General

- 1. Isolation: Where lathing and metal support system abuts building structure horizontally, isolate the work from structural movement sufficiently to prevent transfer of loading into the work from the building structure. Install casing beads where ceilings abut walls. Frame both sides of control joints independently and do not bridge joints with furring and lathing or accessories.

B. Metal Lathing

- 1. Install metal lath to comply with referenced standards, unless otherwise indicated.

- a. Attach to studs thru sheathing and building wrap with No. 8 cadmium plated 1-1/4 inch screws with 1/2 inch diameter flat wafer head, spaced 8 inches on center along each stud.
 - b. Side and end joints shall be lapped at least once between supports and laps shall be made only at supports.
- C. Stucco Accessories
1. Anchor each flange of accessories 8 inches on center, or more often if recommended by manufacturer for plastic accessories, to plaster base.
 2. Miter or cope accessory corners and install with tight joints accurately aligned.
 3. Set accessories plumb, level and true to line with a tolerance of 1/8 inch in 10 feet.
 4. Install casing beads at termination of plaster work, except where plaster is indicated to pass through other work and be concealed by lapping work.
 5. Install control joints in ceilings not to exceed 12 feet on center in both directions.

3.02 PROPORTIONING AND MIXING

- A. Mechanically mix plaster materials at the project site; do not hand mix, except where small amounts are needed using less than 1 bag of plaster. Measurements shall be by volume or weight as specified. Do not use any frozen, caked, or lump materials, or material that has partially set. Retempered stucco that has partially set shall not be used. Clean mixer of all set or hardened material before materials for a new batch are loaded. Keep mixing tools and equipment clean. Mix each batch separately. The mixing sequence and cycle of operations and time shall be in accordance with the manufacturer's directions.
- B. Masonry Cement Stucco Basecoat: Mix scratch coat in the proportion of one part by volume of masonry cement to not less than 2 1/2 nor more than 4 parts by volume of damp loose sand. Mix brown coat in the proportion of one part by volume of masonry cement to not less than 3 parts nor more than 5 parts by volume of damp loose sand. Brown coat shall have the same proportion of sand used in the scratch coat or a greater proportion of sand than used in the scratch coat, within the limit specified.

3.03 STUCCOING

- A. Sequence stucco installation properly with the installation and protection of other work, so that neither will be damaged by the installation of the other.
- B. Before stuccoing, inspect surfaces to receive stucco and see that grounds, screeds and lath are secured in place. See that grounds are set to receive the specified thickness of stucco. Inspect metal accessories, metal lath and metal frames for rusting or conditions that will stain the finished plaster, correct such conditions.
- C. Stucco application shall be performed in three coats: The scratch coat (first) coat shall be applied with sufficient material and pressure to form good full key on metal lath, and a good bond on other bases, and then be cross-raked. The brown (second) coat shall be applied after the scratch (first) coat has set firm and hard, brought out to within 1/8" of finish coat and straightened to a true surface with rod and darby without the use of additional water and left smooth to receive the third coat.
- D. The scratch and brown coats shall applied manually by experienced mechanics.
- E. Cure stucco by maintaining each coat in a moist condition for 2 days following application; keep enclosed and fog spray (after initial set) as required to prevent dry-out.
- F. Finish Coat: Apply finish coat over smooth stucco brown coat.
- G. Contractor shall prepare samples of stucco system including substrate, lathe, base and finish coats, color and texture for approval by Architect.
- H. Total thickness to be 3/4" to 7/8".

3.04 CUTTING AND PATCHING

- A. Cut, patch, point-up and repair plaster as necessary to accommodate other work and to restore cracks, dents and imperfections. Repair or replace work to eliminate blisters, buckles, excessive crazing and check cracking, dry-outs, efflorescence, sweat-outs and similar defects, including areas of the work which do not comply with specified tolerances, and where bond to the substrate has failed.

3.05 CLEANING AND PROTECTION

- A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows and other surfaces which are not to be plastered. Repair floors, walls and other surfaces which have been stained, marred, or otherwise damaged during the plastering work. When plastering work is completed, remove unused materials, containers and equipment and clean floors of plaster debris.
- B. Installer shall advise Contractor of requirements for the protection of plaster from deterioration and damage during the remainder of the construction period.

END OF SECTION

SECTION 09.255 GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Mold and Mildew Resistant Gypsum Board
 - 2. Tile backer board
 - 3. Glass-Mat Gypsum Sheathing Board
 - 4. Impact Resistant Gypsum Board
 - 5. Shaftliner Gypsum Board
 - 6. Wallboard finishing (joint tape-and-compound treatment)
 - 7. Gypsum wallboard accessories including reveals
 - 8. Levels of Gypsum Board Finish
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry"
 - 2. Division 7 Section "Joint Sealants"
 - 3. Division 9 Section "Metal Support Assemblies"
 - 4. Division 9 Section "Tile"
 - 5. Division 9 Section "Painting"

1.02 SUBMITTALS

- A. Product Data
 - 1. Submit manufacturer's product specifications and installation instructions for each gypsum board component, including other data as may be required to show compliance with these specifications.
 - 2. Product Data: Provide Safety Data Sheets for fire resistant (Type X) gypsum board.
- B. Samples: 12 inch long sample of reveals, in finish specified.

1.03 QUALITY ASSURANCE

- A. Manufacturer: Obtain gypsum board products from a single manufacturer.
 - 1. Provide products manufactured in North America only.
- B. Gypsum Board:
 - 1. "GA-216, Application and Finishing of Gypsum Panel Products" by Gypsum Association
 - 2. "GA-214, Recommended Levels of Gypsum Board Finish" by Gypsum Association.
- C. Allowable Tolerances: 1/8" in 8' -0" variation in finish surface

- 1.04 DELIVERY, STORAGE, AND HANDLING
- A. Store gypsum in accordance with GA-238 and manufacturer recommendations.
 - B. Deliver materials in original packaged, containers or bundles bearing brand name and identification of manufacturer or supplier
 - C. Store materials inside under cover and in a manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.
 - D. Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal corner beads and trim from being bent or damaged.

- 1.05 PROJECT CONDITIONS
- A. Cold Weather Protection: When ambient outdoor temperatures are below 55°F., maintain continuous, uniform, comfortable building working temperatures of not less than 55°F. for a minimum period of 48 hours prior to, during and following application of gypsum board and joint reinforcement materials or bonding of adhesives.
 - B. Ventilation: Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Gypsum Board
 - 1. Georgia-Pacific
 - 2. US Gypsum Company (USG)
 - 3. CertainTeed Gypsum
 - 4. Temple-Inland Corporation

2.02 MATERIALS

- A. Mold and Mildew Resistant Gypsum Board: ASTM C 1396, of thickness indicated below to resist mold and mildew; in maximum lengths available to minimize end-to-end butt joints. Board shall score minimum 10 when tested per ASTM D 3273.
 - 1. Type X, 5/8 inch thick, for fire-resistant rated assemblies and where indicated.

2. Provide at ALL interior areas unless noted otherwise.
- B. Tile Backer Board (provide at all locations where wall tile occurs and other areas indicated). Board shall score minimum 10 when tested per ASTM D 3273.
 1. 5/8" DensShield Tile Backer Board as manufactured by Georgia Pacific Corporation.
 2. 5/8" Fiberock Aqua-Tough as manufactured by USG Corporation.
 3. 5/8" Diamondback GlasRoc Tile Backer as manufactured by CertainTeed Corporation
 4. 5/8" GreenGlass Tile Backer as manufactured by Temple Inland.
 - C. Glass-Mat Gypsum Sheathing Board: ASTM C 1177, of types, thickness indicated below; in maximum lengths available to minimize end-to-end butt joints:
 1. 5/8" DensGlass Sheathing as manufactured by Georgia Pacific Corporation.
 2. 5/8" Securock Glass Mat Sheathing as manufactured by USG Corporation.
 3. 5/8" GlasRoc Sheathing as manufactured by CertainTeed Corporation.
 4. 5/8" GreenGlass Exterior Sheathing as manufactured by Temple Inland.
 - D. Impact Resistant Gypsum Board: ASTM C1396, Level 3
 1. 5/8" DensArmor Plus Impact Resistant as manufactured by Georgia Pacific Corporation.
 2. 5/8" Mold Tough VHI as manufactured by USG Corporation.
 3. 5/8" Air Renew Extreme Impact as manufactured by CertainTeed Corporation
 4. 5/8" ComfortGuard IR as manufactured by Temple Inland.
 - E. Shaftliner Gypsum Board: provide at all mechanical shafts where indicated.
 1. 1" DensGlass Shaftliner as manufactured by Georgia Pacific Corporation.
 2. 1" Mold Tough Gypsum Liner Panels as manufactured by USG Corporation.
 3. 1" GlasRoc Shaftliner as manufactured by CertainTeed Corporation
 4. 1" GreenGlass Shaftliner as manufactured by Temple Inland.

2.03 ACCESSORIES

- A. General: Except as otherwise specifically indicated, provide trim and accessories by manufacturer of

gypsum board materials, made of galvanized steel (required at exterior) or zinc alloy and configured for concealment in mold resistant joint compound.

1. Include corner beads, edge trim, control joints and other units necessary for project conditions. Provide accessories as required in order to achieve details indicated, whether or not specific accessories are shown on the drawings.
2. Comply with ASTM C1047-10a Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base, current version.

B. Reveals

1. Material: extruded aluminum, color to be selected by Architect.
2. Provide "J-molding -JDM-625" as manufactured by Fry Reglet Corporation or "200-A" as manufactured by USG where gypsum board terminates on surface and other locations indicated on Drawings.
3. Provide "Reveal Molding" as manufactured by Fry Reglet Corporation in sizes and locations indicated on Drawings.
4. Provide "860-5/8" as manufactured by Gordon, Inc. where wall metal reveal base is called for on drawings.
5. Provide "Light Cove 1066T" 6 inch x 8-7/8 inch extruded aluminum cove as manufactured by Gordon, Inc. located at light coves in restroom areas above the vanities and the toilets. Finish to be coating suitable for priming and painting to match adjacent surfaces.
6. Provide "660-90", 6", 90 degree inside corner as manufactured by Gordon, Inc. located above light coves in restroom areas. Finish and paint to match adjacent surfaces.
7. Provide other reveals where indicated on Drawings.

C. Joint Treatment Materials:

1. General: Comply with ASTM C475 Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board, current version.
2. Glass-Fiber Mesh Tape: Self-adhering glass-fiber tape, alkali resistant, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch. Mold resistance rating score of 10 when tested in accordance with ASTM D 3273.
 - a. For use at all boards (mold and mildew interior, tile backer, and glass-mat sheathing)

- b. Certaineed "FibaTape Mold-X10" is an acceptable alternative (1-7/8" wide).
- 3. Exterior sealant: Silicone Emulsion Sealant meeting ASTM C 920, Type S, Grade NS, compatible with glass fiber mesh tape and for covering exposed fasteners.
- 4. Setting Type Joint Compound: Factory prepackaged, job mixed chemical-hardening powder products for bedding and filling.
 - a. Provide equal to USG "Sheetrock Brand Easy Sand Lightweight Setting-Type Joint Compound".
 - b. Use for all areas requiring setting or topping compound (ie: taping, filling, and treating fasteners).
- D. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Fasteners: Steel drill screws, in lengths recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating.
 - 1. For steel framing less than 0.0329 inch thick, attach sheathing with steel drill screws complying with ASTM C1002, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - 2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing with drill screws complying with "ASTM C954 Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. to 0.112 in. in Thickness".
 - 3. Provide Type S or Type S-12 screws only.

PART 3 EXECUTION

3.01 PREPARATION

- A. Do not deliver or install gypsum board until building is fully enclosed, wet work is complete.
- B. Prior to finishing, HVAC system shall be operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

3.02 EXAMINATION

- A. Examine substrates to which gypsum board construction attaches or abuts, installed hollow metal frames, cast-in anchors and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of gypsum board assemblies specified in this Section.
1. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. General

1. Install and finish in accordance with "GA-216, Application and Finishing of Gypsum Panel Products", with manufacturer's printed directions and recommendations, and to comply with applicable fire tests where fire rated construction is required.
 2. Install boards with correct side out (typically logo side out). Use maximum lengths possible to minimize number of joints.
 3. Apply fasteners so screw heads bear tightly against face of boards but do not cut into facing (no countersinking).
 4. Horizontal Installation: Install sheathing with long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of stud flanges, and stagger end joints of adjacent boards not less than one stud spacing. Screw-attach boards at perimeter and within field of board to each steel stud.
 5. Caulk/seal cut edges and penetrations around pipes, fixtures, etc., and where sheathing butts against dissimilar materials with applicable sealant.
 6. Do not install imperfect, damaged or damp boards.
 7. Finishing, General: Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim and control joints; penetrations; fastener heads, surface defects and elsewhere as required to prepare work for decoration.
- B. Mold and Mildew Resistant Gypsum Board (includes impact resistant)

1. Cut boards at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
 - a. Install boards with a minimum 1/4 inch setback at wall-to-floor intersections.
 - b. Allow no joints greater than 1/8 inch.
 2. Fastener Spacing
 - a. Space fasteners approximately 8 inches o.c. along supported edges and 12 inches o.c. along intermediate supports (or tighter spacing if recommended by manufacturer for specific application) and set back a minimum of 3/8 inch from edges and ends of boards.
 3. Joints and corners shall be treated with 2" fiberglass tape embedded in a skim coat of setting material as specified herein.
 - a. Skim coat all fasteners with setting material.
- C. Tile Backer Board
1. Comply with Division 9 Section "Tiling" and TCA Handbook for Ceramic Tile Installation.
 2. Cut boards at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
 - a. Install boards with a 1/4 inch setback where they abut shower receptors to prevent wicking.
 - b. Allow no joints greater than 1/8 inch.
 3. Do not install an additional vapor barrier in conjunction with tile backer boards.
 4. Horizontal Installation: Install sheathing with long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of stud flanges, and stagger end joints of adjacent boards not less than one stud spacing. Screw-attach boards at perimeter and within field of board to each steel stud.
 5. Fastener Spacing
 - a. Space fasteners approximately 6 inches o.c. (or tighter spacing if recommended by manufacturer for specific application) and set back a minimum of 3/8 inch from edges and ends of boards.
 6. Joints and corners shall be treated with 2" fiberglass tape embedded in a skim coat of the tile setting material as specified in Division 9 Section "Tiling".
 - a. Skim coat all fasteners with tile setting material.

7. Where tile backer board is indicated to be painted, finish per "Mold and Mildew Resistant Gypsum Board" as specified herein.
- D. Glass-Mat Gypsum Sheathing Board:
1. Cut boards at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
 - a. Install boards with a 3/8-inch setback where non-load-bearing construction abuts structural elements.
 - b. Install boards with a 1/4-inch setback where they abut masonry or similar materials that might retain moisture, to prevent wicking.
 - c. Allow no typical joints greater than 1/8 inch.
 2. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.
 3. Fastener Spacing:
 - a. Space fasteners approximately 8 inches o.c. (or tighter spacing if recommended by manufacturer for specific application) and set back a minimum of 3/8 inch from edges and ends of boards.
 4. Joints and corners shall be treated with 2" fiberglass tape embedded in a skim coat of setting material as specified herein.
 - a. Skim coat all fasteners with setting material.
- E. Shaftliner Gypsum Board
1. Screw attach base and face layers according to manufacturer's instructions.
 2. Seal perimeters and openings to provide airtight installation.
 3. Finishing and other requirements per "Mold and Mildew Resistant Gypsum Board".
- F. Accessories
1. Trim
 - a. Use same fasteners to anchor trim accessory flanges as required to fasten gypsum board to supports, unless otherwise recommended by trim manufacturer.
 - b. Install metal corner beads at external corners and "reveals" in locations as indicated on the Drawings or as specified herein.
 - (1) Install metal casing bead trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, unless a "reveal" product is called for on Drawings.

- c. Miter all trim at inside & outside corners and at all trim intersections.
- 2. Control Joints
 - a. Install control joints at locations indicated, or if not indicated, at spacings and locations required by "GA-216, Application and Finishing of Gypsum Panel Products", and as specified herein. Locations shall be approved by Architect prior to installation for visual effect.
 - (1) Install control joints at junction of gypsum board partitions with walls or partitions of other finish material.
 - (2) A control joint shall be installed where a partition, wall, or ceiling traverses a construction joint (expansion, seismic, or building control element) in the base building structure.
 - (3) Control joints shall be installed where a wall or partition runs in an uninterrupted straight plane exceeding 30 linear feet.
 - (4) Control joints in interior ceilings shall be installed so that linear dimensions between control joints do not exceed 30 linear feet.
 - (5) Where gypsum board is vertically continuous, as at stairwells, provide horizontal control joints at each floor level.
 - (6) A control joint or intermediate blocking shall be installed where ceiling framing members change direction.
 - (7) Where a control joint occurs in an acoustical or fire-rated system, blocking shall be provided behind the control joint by using a backing material of 5/8 in. type X Mold and Mildew resistant gypsum board as specified herein, mineral fiber, or other tested equivalent.

3.04 LEVELS OF GYPSUM BOARD FINISH

- A. Levels of Finish: Provide in accordance with Gypsum Association "GA 214, Recommended Levels of Gypsum Board Finish".
 - 1. Level 1: Ceiling plenum areas, exterior, and concealed areas, except provide higher level of

finish as required to comply with fire resistance ratings and acoustical ratings.

- a. All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
2. Level 2: all Tile Backer gypsum surfaces to receive tile.
 - a. All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.
 3. Level 3: Gypsum board substrate at areas of textured finishes and heavy duty wall coverings.
 - a. All joints and interior angles shall have tape embedded in joint compound and one additional coat of joint compound applied over all joints and interior angles. Fastener heads and accessories shall be covered with two separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges.
 4. Level 4: Provide in all conspicuous areas.
 - a. All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges.
 5. Level 5: None in this project.

3.05 PARTITION IDENTIFICATION

- A. Place identification on all partitions indicated on Drawings as having a required fire or smoke rating.

- B. Identification shall be as follows:
 - 1. Location: 10 feet on center, both sides of partitions, above ceiling lines.
 - a. Place above access panels in hard ceilings.
 - 2. Style of Lettering: 2 inches high, helvetica style, painted with aid of stencils.
 - 3. Color: Red.

3.06 FIELD QUALITY CONTROL

A. Tolerances

- 1. Do not exceed 1/8 inch in 8'-0" variation from plumb or level in exposed lines of surface, except at joints between gypsum board units.
- 2. Do not exceed 1/16 inch variation between planes of abutting edges or ends.
- 3. Shim as required to comply with specified tolerances.

3.07 CLEANING

A. Remove and recycle all excess material.

- 1. Separate clean waste gypsum products from contaminants for recycling. Do not include wood, plastic, metal, asphalt-impregnated gypsum board, or any gypsum board coated with glass fiber, vinyl, decorative paper, paint, or other finish. Place in designated area and protect from moisture and contamination.
- 2. Separate metal waste and place in designated areas for recycling or reuse.

3.08 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

- 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
- 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

GYPSUM BOARD ASSEMBLIES

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SECTION 09.300 TILE

PART 1 GENERAL

1.01 SUMMARY

- A. Definitions-Tile includes ceramic surfacing units made from clay or other ceramic materials. The types of work of this section include:
 - 1. Ceramic Wall Tile
 - 2. Tile Trim and Accessories to achieve a complete installation.
- B. Related Sections include the following:
 - 1. Division 7 Section "Joint Sealants"
 - 2. Division 9 Section "Resilient Tile Flooring"
 - 3. Division 9 Section "Carpeting"

1.02 SUBMITTALS

- A. Samples: Submit manufacturer's color charts consisting of actual tiles or sections of tiles showing full range of colors available for each type of tile specified.
- B. Shop Drawings: Submit shop drawings including tile and their specific locations as indicated on the drawings. Show expansion joint locations for approval.
- C. Grout manufacturer's color chart and instructions for use of grout.

1.03 QUALITY ASSURANCE

- A. Tile Manufacturing Standard: ANSI A137.1. Furnish tile complying with standard grade requirements unless indicated otherwise.
- B. Provide materials obtained from one source for each type and color of tile, grout, and setting materials.
- C. Tile Council of America, Inc.
 - 1. Handbook No. F113A-11 (thinset) at all above ground concrete areas.
 - 2. Handbook No. W245-11 for wall tile installed over backerboard.
- D. Tile Installation Standards: ANSI Standards -Comply with applicable requirements of the following, except as otherwise indicated:
 - 1. ANSI A108.5. Tiles installed with Latex-Portland Cement Mortar; for ceramic tile base without wall tile.
 - 2. ANSI A108.10: installation of grout in tilework.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Deliver packaged materials and store in original containers with seals unbroken and labels intact until time of use, in accordance with manufacturer's instruction. All cartons must be from same Lot.

1.05 PROJECT CONDITIONS
A. Maintain environmental conditions and protect work during and after installation in accordance with referenced standards and manufacturer's printed recommendations. All cartons must be from the same lot.

PART 2 PRODUCTS

2.01 TILE MATERIALS
A. General
1. Colors, patterns, and locations of all tile types are as indicated on the Drawings.
B. PCT1 - **Alfa Lux; Olimpia; Clay; Lappato Rectificato.**
Equals: Rex: Travertini di Rex; Emil America: Marmo Accro Stone. Size 12"x24".
C. Colors for all tiles to be selected from manufacturer's full range.

2.02 SETTING MATERIALS
A. Manufacturers
1. Laticrete International
2. MAPEI Americas
3. Mer-Krete Systems.
B. General
1. Color as selected by Architect from manufacturer's full line.
C. Thinset Installation (wall):
1. Mortar: ANSI A118.4, latex portland cement mortar (on a cured bed).
2. Grout: ANSI A118.7, Polymer modified cement grouts.

2.03 EXPANSION JOINTS
A. Provide in accordance with Tile Council of America "EJ171 Movement Joint Guidelines for Ceramic, Glass, and Stone":
1 Back-up strip: flexible and compressible type of closed cell foam polyethylene or butyl rubber, rounded at surface to contact sealant, and as recommended by the sealant manufacturer.

2. Sealant: Two component sealant shall comply with Fed. Spec. TT-S-00227e; use Type II (non-sag) for joints in vertical surfaces and Type I (self-leveling) for joints in horizontal surfaces. Trafficked areas of floors -Shore A hardness greater than 35.

2.04 ACCESSORIES

- A. Provide accessories in locations as indicated on Drawings and as specified herein.
- B. Termination Strip
 1. Between ceramic tile and resilient flooring or carpet: Schlüter RENO-U, sized for each application, type 304 stainless steel.
 2. Between ceramic tile and sealed concrete: Schlüter RENO-V, sized for each application, type 304 stainless steel
 3. At outside corners of tile: Schlüter Rondec, sized for each application, type 304 stainless steel.
 4. At inside corners of tile: Schlüter Dilex-EHK, sized for each application, type 304 stainless steel.
 5. At transition of wall tile to plate glass mirror perimeter: Schlüter Rondec-E, sized for each application, type 304 stainless steel.
- B. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Tilework
 1. Extend tile work into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges and corners without disrupting pattern or joint alignments.
 2. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures and other penetrations, so that plates, collars or covers overlap tile.

3. Placement Methods
 - a. Install tile on floors and masonry walls using Dry-Set or Latex-Portland Cement.
 - b. Install base without wall tile using Dry-Set or Latex-Portland Cement.
 4. Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Layout tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform grout joints in widths as recommended by the tile manufacturer.
 5. Grout: Install in accordance with applicable ANSI standard as specified herein.
- B. Expansion Joints
1. Install where required per TCNA "EJ171", where required below, and per approved layout.
 - a. Interior locations (above grade): 8' to 12' in each direction
 - b. Install where tile work abuts restraining surfaces such as perimeter walls, curbs, columns, pipes, changes in backing materials, etc.
 - c. Install directly over joints in structural floor including construction joints or cold joints.
 2. Joints shall be same width as grout joint, but not less than 1/8".
 3. Set compressible back-up strip when mortar is placed or utilize removable wood strips to provide space for back-up after mortar has cured.
 4. Keep movement joints cavities open and free of dirt, debris, grout, mortar, and setting materials.
 5. Install sealant after tile work and grout are dry. Follow sealant manufacturer's recommendations.
- C. Grout Sealer: Provide one coat of grout sealer to all grout joints using foam rubber paint brushes. Care shall be taken to avoid excessive drippage and runs onto tile.

3.02 CLEANING

- A. Upon completion of placement and grouting, clean all tile surfaces so they are free of foreign matter. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but not sooner than 14 days after installation. Protect metal surfaces, cast

iron and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.

- B. Finished Tile Work: Leave finished installation clean and free of non-uniform joints, cracked, chipped, broken, unbonded, or otherwise defective tile work.

3.03 PROTECTION

- A. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile. Protect installed tile work with Kraft paper or other heavy covering during construction period to prevent damage and wear.
 - 1. Prohibit foot and wheel traffic from using tiled floors for at least 7 days after grouting is completed.
 - 2. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION

SECTION 09.511 ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Extent of each type of acoustical ceiling is shown and scheduled on drawings.
- B. Types of acoustical ceilings specified in this section include the following:
 - 1. Acoustical panel ceilings, exposed suspension.
- C. Related Sections include the following:
 - 1. Division 9 Section "Gypsum Board Assemblies" for gypsum board ceilings

1.02 SUBMITTALS

- A. Product Data: Manufacturer's product specifications and installation instructions for materials and suspension system, including certified laboratory test reports and other data as required showing compliance with these specifications.
- B. Coordination Drawings: layout of ceilings drawn to scale coordinating acoustical tile ceiling installation and spacing with hanger attachment to building structure and ceiling mounted items. Include locations of all mechanical and electrical items (light fixtures, mechanical items, fire alarm, and sprinkler heads).
 - 1. Architect will provide a CAD drawing of the reflected ceiling plan for the contractor's use in preparing. This is to be used as a guide only - it is the responsibility of the Contractor to ensure that all tile is centered in the space and all items are located properly.
- C. Samples: Set of samples for acoustical unit, showing full range of exposed color and texture, and set of 12" long samples of suspension system.

1.03 QUALITY ASSURANCE

- A. Installer: Firm with not less than three years of successful experience in installation of acoustical ceilings similar to requirements for this project and which is acceptable to manufacturer of acoustical units.

- 1.04 DELIVERY, STORAGE, AND HANDLING
- A. Deliver acoustical ceiling units to project site in original unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination or other causes.
 - B. Before installing acoustical ceiling units, permit them to reach room temperature and stabilized moisture content.
 - C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way. Minor damages may be repaired, provide finish items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

- 1.05 PROJECT CONDITIONS
- A. Space enclosure -Do not install interior acoustical ceilings until space is enclosed and weather-proof, until wet work in space is completed and nominally dry, until work above ceilings is completed, and until ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

- 1.06 EXTRA MATERIALS
- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size tiles equal to 2.0 percent of quantity installed, but not less than 1 box per tile type.

PART 2 PRODUCTS

- 2.01 MANUFACTURERS
- A. Armstrong World Industries
 - B. USG Corporation
 - C. CertainTeed Ceilings

- 2.02 MINERAL FIBER ACOUSTICAL PANELS
- A. General: Where units less than 6 inches wide would occur at edges of room with 24 X 24 inch pattern, provide 24 X 48 inch panels cut to extend to wall, eliminating the tee near the wall. Where regular

tiles occur at these locations, modify tile to sit flush with suspension system.

- B. Type 1 (ACT1), beveled tegular edge typical
 - 1. NRC - 0.70; CAC-35
 - a. 2'x2'x3/4" Ultima Beveled Tegular (1912) by Armstrong with AirGuard Coating.
 - b. 2'x2'x3/4" Mars ClimaPlus FLB Edge (86985) by U.S.G.
 - c. 2'x2'x3/4" Symphony-m Narrow Reveal Edge (1222F-OVT-1) by Certainteed.
- C. Type 2 (ACT2)
 - 1. NRC-0.95
 - a. TechZone Ceiling System by Armstrong or approved equal. 6" wide technical zone; 30"x30" Lyra field panels - 8359.
- D. Type 3 (ACT3)
 - 1. NRC-0.40
 - a. Woodworks Linear Planks by Armstrong or approved equal. Nominal 6" Module, 646OW1NDC.

2.02 CEILING SUSPENSION MATERIALS

- A. General: Comply with ASTM C635, as applicable to type of suspension system required for type of ceiling units indicated. Provide UL listed system for fire rated ceilings. Coordinate with other work supported by or penetrating through ceilings, including light fixtures and HVAC equipment.
 - 1. Structural Class: Intermediate-duty.
- B. Attachment Devices: Size for 5 times design load indicated in ASTM C635, Table 1 Direct Hung. Hanger Wires-galvanized carbon steel, ASTM A641, soft temper, prestretched, yield-stress load of at least 3 times design load, but not less than 12 gage (0.106").
- C. Edge Molding: provide manufacturer's standard wall angle (7/8" hemmed angle molding) for edges of ceiling of material and finish to match exposed tee flanges in same space.
- D. Perimeter Trim
 - 1. Horizontal gypsum board to ACT
 - a. Provide equal to Armstrong "Axiom Transitions AXTRTESTR"
 - 2. Vertical gypsum board to ACT
 - a. Provide equal to Armstrong "Axiom Classic AX2STR"

- 3. Accent Walls
 - a. Provide equal to Armstrong "Axiom Direct Light Coves AXDLC44". Include wall attachment clips, hold down clips, and bottom trim as required.
- 4. Cove Ceilings
 - a. Provide equal to Armstrong "Cove Perfekt-Axiom".
- E. Provide "retention clips" at all areas (equal to Armstrong 414).
- F. Exposed Suspension System: Manufacturer's standard exposed tees, cross tees and accessories of types indicated, with exposed cross tees coped to lay flush with main runners. Hot dipped galvanized steel on all surfaces of ceiling suspension system, including mouldings, trim and accessories. Fire rated suspension system with fire rated ceiling units.
- G. Suspension System
 - a. Suprafine XL 9/16 by Armstrong.
 - b. Centricitee DXT Narrow Face Tee Grid System by USG.
 - c. Elite Narrow Stab System 9/16" Narrow Grid System by Certainteed.
- H. Provide a complete suspension and 4 inch trim kit with factory mitered corners equal to Armstrong "Axiom Vector" where indicated. Kit shall include mounting system capable of recessing the edge cable 2 feet away from vertical face of the "cloud".

PART 3 EXECUTION

3.01 EXAMINATION

- A. Installer must examine conditions under which acoustical ceiling work is to be performed and must notify Contractor in writing of unsatisfactory conditions. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.02 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling - in accordance with approved coordination layout drawing.

3.03 INSTALLATION

ACOUSTICAL PANEL CEILINGS

- A. General: Install materials in accordance with manufacturer's printed instructions and to comply with governing regulations, fire resistance rating requirements as indicated, and industry standard applicable to work.
- B. Install suspension system to comply with ASTM C636, with hangers supported only from building structural members or from carrying channels supported by structural members. Locate hangers near each end and spaced maximum 4' -0" along each main tee and as required by UL assembly unless otherwise indicated, leveling to tolerance of 1/8" in 12' -0". Provide extra hangers and carrying channels as required to support weight at lighting fixtures and duct outlets.
- C. Install edge mouldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units. Attach mouldings to substrate at intervals not over 16" o.c. and not more than 3" from ends, leveling with ceiling suspension system to tolerance of 1/8" in 12' -0". Miter corners accurately and connect securely.
- D. Install acoustical panels in coordination with suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.

3.04 CLEANING

- A. Clean exposed surfaces of acoustical ceilings, including trim, edge mouldings and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09.651 RESILIENT TILE FLOORING

PART 1 GENERAL

1.01 SUMMARY

- A. Extent of resilient flooring and accessories is shown on Drawings and in schedules. Work includes the following:
 - 1. Luxury Vinyl Tile
 - 2. Static Dissipative Tile
 - 3. Accessories including Rubber Base.
 - 4. Patterns and locations of all flooring and accessories are as indicated on the Drawings. Colors shall be selected by the Architect.
- B. Related Sections include the following:
 - 1. Division 9 Section "Carpeting"

1.02 SUBMITTALS

- A. Product Data: Provide Safety Data Sheets for floor tile and adhesives.
- B. Samples: Submit sample of each type, color and finish of resilient flooring and accessory required, indicating full range of color and pattern variation. Provide full-size tile units for VCT and 6" long sample of accessories.
- C. Maintenance Instructions: Submit 2 copies of manufacturer's recommended maintenance practices for each type of resilient flooring and accessory required.

1.03 QUALITY ASSURANCE

- A. Manufacturer: Provide each type of resilient flooring and accessories as produced by a single manufacturer, including recommended primers, adhesives and sealants.
- B. Provide resilient flooring material to meet the following fire test performance criteria as tested by a recognized independent testing laboratory:
 - 1. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I.
 - 2. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less.

1.04 PROJECT CONDITIONS

- A. Maintain minimum temperature of 65 degrees (18 Celsius) in spaces to receive resilient flooring for

at least 40 hours prior to installation, and during installation. Subsequently, maintain minimum temperature 55 degrees (13 Celsius) in areas where work is completed.

- B. Install resilient flooring and accessories after other finishing operations, including painting, have been completed. Moisture content of concrete slabs and environmental conditions must be within limits recommended by manufacturer of products being installed. Moisture that results must be submitted in writing to the Owner prior to installation.

1.05 WARRANTY

- A. Provide manufacturer's standard finish and wear warranties for all products.

1.06 MAINTENANCE

A. Extra Stock

1. After completion of work, deliver to project site replacement materials from manufactured lot as materials installed.
2. Provide not less than one box of tile flooring for each 50 boxes or fraction thereof, for each type, size, and color installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Luxury Vinyl Tile (LVT1)

1. Tandus Centiva
2. Amtico
2. Eykon
4. Shaw

B. Static Dissipative Resilient Flooring (SDT)

1. Armstrong World Industries
2. Mannington
3. Shaw

C. Accessories (Resilient)

1. Johnsonite, Inc.
2. Roppe Corporation
3. Flexco

D. Accessories (Metal Transition Strips)

1. Schluter-Schiene 3mm Satin Anodized Aluminum
 - A. Basis of Design

E. Substitutions

1. Subject to compliance with requirements, products of other manufacturers may be substituted upon matching Architect's control sample in color, texture, and size.

2.02 MATERIALS

A. Luxury Vinyl Tile (LVT):

1. LVT1: Provide Event Series "Morrocan Quartzite" as manufactured by Tandus Centiva.
 - a. Size: 12 inch x 18 inch
 - b. Edge: Square
 - c. Wear Layer Thickness: 30mils
 - d. Pattern: Vertical Ashlar

B. Static Dissipative Tile (SDT):

1. SDT: Provide "Excelon" as manufactured by Armstrong World Industries, Inc.
 - a. Size: 12 inch x 12 inch
 - b. Edge: Square
 - c. Thickness: 1/8"
 - d. Color: To be selected by Architect from manufacturers full line of colors.
2. References: Thru-color products conforming to the requirements of ASTM F 1066, Class 2 - through pattern, through chip.
3. Composed of polyvinyl chloride resin binder, fillers, pigments, and antistatic additive with colors and texture dispersed uniformly throughout its thickness.

2.03 ACCESSORIES

A. Stair Treads, Risers, and Landings

1. General
 - a. References: ASTM F-2169 Standard Specification for Resilient Stair Treads, Type TS.
 - b. The treads shall be homogeneously constructed of first-quality resilient rubber compound and the color shall extend throughout the thickness of the tread. All treads shall be free from objectionable odors, blisters, cracks, and other imperfections which will detract from the serviceability and appearance of the treads.
2. Treads: Provide "#96 Raised Circular Vantage Design" with Abrasive Glow Strip as manufactured by Roppe Corporation.

- a. Size: 12" nominal from inside of tapered nose, lengths as required for no seams.
 - b. Thickness: 3/16" to .1/8"
 - c. Provide colors as indicated on Drawings, or if not indicated, as selected by Architect.
 - 3. Risers: Provide "Rubber Riser" as manufactured by Roppe Corporation.
 - a. Height: as required to underside
 - b. Thickness: .100"
 - c. Provide colors to match stair treads.
 - 4. Landings: Provide "#996 Raised Circular Vantage Design -Rubber Landing Tile" as manufactured by Roppe Corporation.
 - a. Size: 19 11/16" x 19 11/16"
 - b. Thickness:
 - (1) Nominal Thickness: Tile thickness without profile: 1/8"
 - (2) Tile thickness with profile: 9/64"
 - (3) Profile thickness: 1/45"
 - c. Provide colors to match stair treads.
- B. Resilient Base (RB1 & RB2):
- 1. References: The base shall conform to the requirements of ASTM F 1861, Type TS, Group I (solid).
 - 2. Product Description
 - a. "Traditional Wall Base, rubber as manufactured by Johnsonite, Inc.
 - b. Products shall be constructed of first quality materials properly vulcanized, and shall be smooth and free from imperfections which detract from its appearance.
 - 3. Height
 - a. RB1 & RB2: 6", unless otherwise indicated.
 - 4. Gauge/Thickness: 1/8 inch
 - 5. Style: Standard top-set cove
 - a. Provide prefabricated inside and outside corners.
 - b. Base over LVT/SDT/CPT: coved bottom
 - 6. Lengths: In coils / rolls to limit joints
 - 7. Colors: To be selected by Architect from manufacturers full line of colors.
- C. Adhesives (Cements):
- 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Floor Adhesives: Not more than 60 g/L.

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- b. Cove Base Adhesives: Not more than 50 g/L.
- D. Resilient Edge Strips:
 - 1. Of required thickness, homogeneous vinyl or rubber composition, tapered or bullnose edge, as selected for condition at adjoining other floor surface material and a flush or "tapered" transition, color to match flooring, or as selected by Architect from manufacturer's standard colors.
 - 2. Provide in coils / rolls to limit joints
- E. Concrete Slab Primer:
 - 1. Low-VOC non-staining type as recommended by flooring manufacturer.
- F. Leveling and Patching Compounds:
 - 1. Low-VOC latex-type as recommended by manufacturer of resilient products.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Installer must examine sub-floor surfaces to determine that they are satisfactory. A satisfactory sub-floor surface is defined as one that is smooth and free from cracks, holes, ridges, and coatings preventing adhesive bond, and other defects impairing performance or appearance.
- B. Perform bond and moisture tests on concrete sub-floors to determine if surfaces are sufficiently cured and dry as well as to ascertain presence of curing compounds. Moisture that results must be submitted in writing to the Architect.
 - 1. Perform subfloor Calcium Chloride Tests (and Bond Tests) as described in publication F-5061, "Armstrong Guaranteed Installation System," to determine if surfaces are dry; free of curing and hardening compounds; and ready to receive flooring.
- C. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PREPARATION

- A. Prepare sub-floor surfaces as follows:
 - 1. Sand or grind substrate, if required to provide smooth surface and to remove foreign materials which could interfere with adhesion.

2. Use leveling and patching compounds as recommended by resilient flooring manufacturer for filling small cracks, holes and depressions in sub-floors.
 3. Broom clean or vacuum surfaces to be covered, and inspect sub-floor.
- B. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.
- C. Start of flooring installation indicates acceptance of sub-floor conditions and full responsibility for completed work.

3.03 INSTALLATION

A. General

1. Install resilient flooring using method indicated in strict compliance with manufacturer's current printed instructions and recommendations. Extend resilient flooring into toe spaces, door reveals, and into closets and similar openings.
 - a. Install resilient edge strips as resilient flooring work progresses.
2. Scribe, cut, and fit resilient flooring to permanent fixtures, built-in furniture and cabinets, pipes, outlets, and permanent columns, walls, and partitions.
3. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on sub-floor. Use chalk or other non-permanent marking device.
4. Tightly cement resilient flooring to sub-base without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections. Hand roll resilient flooring at perimeter of each covered area to assure adhesion.

B. Installation of Tile Floors

1. Install tile floors according to color and pattern plans on Drawings.
2. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of room area are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise indicated on Drawings.

3. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged if so numbered. Cut tile neatly around all fixtures. Broken, cracked, chipped, or deformed tiles are not acceptable.
 4. Adhere tile flooring to substrates using full spread of adhesive applied in compliance with flooring manufacturer's directions.
- C. Accessories
1. Apply resilient base to walls, columns, pilasters, face of risers in stairways, casework and other permanent fixtures in rooms or areas where base is required. Install base in lengths as long as practicable, with field formed outside corner units, and with mitered or coped inside corners. Tightly bond base to backing throughout length of each piece, with continuous contact at horizontal and vertical surfaces.
 - a. On irregular surfaces, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
 2. Apply edge strips where shown on drawings and at all exposed edges of resilient flooring. Secure units to substrate in compliance with manufacturer's recommendations.

3.04 CLEANING

- A. Perform following operations immediately upon completion of resilient flooring:
1. Sweep or vacuum floor thoroughly.
 2. Do not wash floor until time period recommended by resilient flooring manufacturer has elapsed to allow resilient flooring to become well-sealed in adhesive.
 3. Damp-mop floor being careful to remove black marks and excessive soil.
 4. Remove any excess adhesive or other surface blemishes, using appropriate cleaner recommended by resilient flooring manufacturers.

3.05 PROTECTION

- A. Comply with resilient flooring manufacturer's current written directions and recommendations.
- B. Protect resilient flooring against damage from rolling loads for initial period following installation by covering with plywood or hardboard in high traffic areas and heavy Kraft paper in

others. Use dollies to move stationary equipment or furnishings across floors.

END OF SECTION

SECTION 09.680 CARPETING

PART 1 GENERAL

1.01 SUMMARY

- A. The extent of carpeting is indicated on the Drawings and the Specifications, and is defined to include carpet and accessories.
 - 1. Modular and broadloom carpet - direct glue-down installation.
- B. Related Sections include the following:
 - 1. Division 9 Section "Tile"
 - 2. Division 9 Section "Resilient Tile Flooring"

1.02 SUBMITTALS

- A. Written warranty as specified above.
- B. Manufacturer's descriptive data.
- C. Flame Spread Test Reports or Radiant Panel Test to verify the meeting of the various requirements specified herein.
- D. Samples, Carpeting - Submit 24 inch x 24 inch samples of each carpet required, and 6" lengths of exposed edge stripping.
- E. Product Data: Provide Safety Data Sheets as specified in Division 1 for carpet adhesives.
- F. Manufacturer's certificate stating that carpet furnished, identified by register numbers was manufactured according to these specifications.
- G. Shop drawings showing layout of carpet, seam location, accessory type and location.

1.03 QUALITY ASSURANCE

- A. Installer: Firm with not less than 5 years of carpeting experience, similar to work of this section.
- B. Manufacturer: Major Firm (carpet mill) which has not less than 5 years of production experience with carpet similar to types specified in this section; and whose published product literature clearly indicates compliance of products with requirements of this section.
- C. General Standard: "Carpet Specifier's Handbook" by the Carpet and Rug Institute; comply with recommendations which can be reasonably applied to types of carpeting work required.
- D. Flammability: Flooring Radiant Panel ASTM E 648 (Glue Down) - NFPA Class I and DOC-FF-1-70.

- E. Flame Spread Rating: Carpeting shall have flame spread rating of 75 or less in accordance with ASTM Spec. E84-68, Standard Method of Test for Surface Burning Characteristics of Building Materials or pass the National Bureau of Standards Radiant Panel Test.
- F. Carpet Identification: Provide hang tag, or other suitable method, to identify carpet delivered as to manufacturer (or supplier), and style.
- G. Maintenance Materials: Deliver usable scraps of carpet to Owner's designated storage space, properly packaged (paper wrapped) and identified. Usable scraps are defined to include roll ends of less than 9'-0" length, and pieces of more than 3 sq. ft. area. Dispose of smaller pieces.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver carpeting material in protective wrapping, and store inside, protected from weather, moisture and soiling.

1.05 WARRANTY

- A. CPT-1 (modular tile)
 - 1. 15 year limited warranty against excessive surface wear, static, delamination, edge ravel, zippering & backing resiliency loss.
 - 2. Lifetime limited modular warranty.
 - 3. Lifetime limited color stain warranty.
 - 4. Lifetime limited static warranty.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Carpet - General
 - 1. Color and Pattern: As indicated on the Drawings or as selected by Architect.
 - 2. Approved Manufacturers: Tandus Flooring (Basis of Design); Interface, Inc.; Shaw Floors; Mohawk.
- B. CPT-1
 - 1. "Construct 04224; Pivot 54206", as manufactured by Tandus|Centiva Flooring.
 - a. Product Size: 24" x 24" Tile
 - b. Total Product Recycled Content:
 - (1) Total: 57.1%
 - (2) Pre-Consumer: 39.3%
 - (3) Post-Consumer: 17.8%
 - c. CRI Green Label Plus Certification

2. Face Construction
 - a. Construction type: Accuweave Patterned Loop
 - b. Face Weight: 30 oz/sq yd
 - c. Gauge: 1/12
 - d. Pile Height (Average): 0.187 inch
 - e. Dye Method: 95% solution / 5% yard dyed
 - f. Primary Tufting Substrate: synthetic non-woven
 3. Secondary Backing
 - a. 100% Recycled Content with ER3 (Barrier System)
 - b. Product Construction: No Delamination per ASTM D-3936
 - c. Secondary Backing Density: 65 lbs/cu ft +/- 5%
 - d. Fiberglass Reinforced
- C. CPT-2
1. "Plexus Colour IV 02875; Purple Haze 18543", as manufactured by Tandus|Centiva Flooring.
 - a. Product Size: Size as needed to install pattern/shapes as indicated in the drawings
 - b. Total Product Recycled Content:
 - (1) Total: 57.1%
 - (2) Pre-Consumer: 39.3%
 - (3) Post-Consumer: 17.8%
 - c. CRI Green Label Plus Certification
 2. Face Construction
 - a. Construction type: Accuweave Patterned Loop
 - b. Face Weight: 24 oz/sq yd
 - c. Gauge: 1/13
 - d. Pile Height (Average): 0.135 inch
 - e. Dye Method: 95% solution / 5% yard dyed
 - f. Primary Tufting Substrate: synthetic non-woven
 3. Secondary Backing
 - a. 100% Recycled Content with ER3 (Barrier System)
 - b. Product Construction: No Delamination per ASTM D-3936
 - c. Secondary Backing Density: 65 lbs/cu ft +/- 5%
 - d. Fiberglass Reinforced
- D. CPT-3
1. "Circlet 02888; North Star 14203", as manufactured by Tandus|Centiva Flooring.
 - a. Product Size: Size as needed to install pattern/shapes as indicated in the drawings
 - b. Total Product Recycled Content:
 - (1) Total: 57.1%
 - (2) Pre-Consumer: 39.3%
 - (3) Post-Consumer: 17.8%
 - c. CRI Green Label Plus Certification

2. Face Construction
 - a. Construction type: Accuweave Patterned Loop
 - b. Face Weight: 24 oz/sq yd
 - c. Gauge: 1/13
 - d. Pile Height (Average): 0.135 inch
 - e. Dye Method: 95% solution / 5% yard dyed
 - f. Primary Tufting Substrate: synthetic non-woven
 3. Secondary Backing
 - a. 100% Recycled Content with ER3 (Barrier System)
 - b. Product Construction: No Delamination per ASTM D-3936
 - c. Secondary Backing Density: 65 lbs/cu ft +/- 5%
 - d. Fiberglass Reinforced
- E. CPT-4
1. Maelstrom 04849; University 33210 Broadloom, with Powerbond Backing, as manufactured by Tandus|Centiva Flooring.
 - a. Product size: 12'-0"
 - b. Total Product Recycled Content
 - 1) Total: 37.4%
 - 2) Pre-Consumer: 37.4%
 - 3) Post Consumer: 0.0%
 - c. CRI Green Label Plus Certification
 2. Face Construction
 - a. Construction type: Tufted Patterned Loop
 - b. Fiber: Antron Lumena Solution Dyed Nylon
 - c. Tufted Pile Weight: 22 oz/sq.yd.
 - d. Gauge: 1/10
 - e. Stitches per inch: 9.6
 - f. Pile Height: High 0.187 inch.
 - g. Pattern Match: 7.20"W x 2.29"L
 - h. Dye Method: 100% Solution Dyed
 - i. Primary Tufting Substrate: Synthetic Woven Polypropylene
 3. Backing
 - a. Primary Backing: Woven Polypropylene
 - b. Primary Backing Construction: 20-year Delamination warranty per ASTM D-3936
 - c. Secondary Backing: Lifelong, Acrylic Polymeric Backing
 - d. Secondary Backing Density: 32 oz. Per sq.yd.

2.02 ACCESSORIES

- A. General: Provide accessories as indicated on Drawings and specified herein.

- B. Carpet Edge Guard
 - 1. Extruded or molded vinyl or rubber of same manufacturer of rubber base of approved size and profile; colors selected by Architect from among standard colors of approved rubber base.
- C. Installation Adhesive: Water-resistant type as recommended by carpet manufacturer, and which complies with flammability requirements for installed carpet and which contains no asbestos, and complies with full warranty.
 - 1. VOC Limits: Provide adhesives with CRI Green Label certified and with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).
- D. Seaming Carpet: Seaming adhesive recommended by carpet manufacturer and which contains no asbestos.
 - 1. Maximum VOC levels: 50 grams/liter. Do not use seam sealants containing 1,1,1-trichloroethane or toluene.
- E. Miscellaneous Materials: As recommended by manufacturers of carpet, and other carpeting products; and selected by installer to meet project circumstance and requirements.
- F. Step and Riser Nosing: Equal to Johnsonite; Solid Color Flexible Vinyl Stair Nosing; VCD-XX (1/4" or 5/16" material on step and riser).

PART 3 EXECUTION

3.01 INSTALLERS

- A. Installer must examine substrates for moisture content and other conditions under which carpeting is to be installed, and notify Owner and Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Clear away debris and remove any cementitious deposits, and other foreign matter which could interfere with adhesive bond, from surfaces to receive carpeting; vacuum clean immediately before installation.
- C. Perform bond and moisture tests on concrete sub-floors to determine if surfaces are sufficiently cured and dry as well as to ascertain presence of curing compounds. Moisture that results must be submitted in writing to the Architect prior to start of installation.

- D. Sequence carpeting with other work so as to minimize possibility of damage and soiling of carpet during remainder of construction period.

3.02 PREPARATION

- A. Pre-ventilate carpet. Unroll and air out carpet in a well-ventilated, uninhabited space for a minimum of 5 hours prior to installation.
- B. Provide maximum ventilation during installation.
- C. Isolate area of installation from rest of building.

3.03 INSTALLATION

A. General

- 1. Comply with manufacturer's instructions and recommendations for seam locations and direction of carpet; maintain uniformity of direction and lay of pile. At doors, center seams under doors; do not place seams in traffic direction at doorways.
- 2. Extend carpet under open-bottomed obstructions and under removable flanges and furnishings, and into adjoining alcoves and closets of each space.
- 3. Provide cut-outs where required, and bind cut edges properly where not protected by edge guards or overlapping flanges.
- 4. Install carpet metal trim where edge of carpet is exposed; anchor guards to substrate.
- 5. At steps and tiers in Tiered Classrooms and Auditorium apply carpet tile to face of the risers and resilient carpet stair nosing continuous.

B. Glue-down Installation

- 1. Fit sections of carpet into each space prior to application of adhesive. Trim edges and butter cuts with seaming cement.
- 2. Apply adhesive uniformly to substrate in accordance with manufacturer's instructions. Butt carpet edges tightly together to form cemented seams without gaps. Roll lightly to eliminate air pockets and ensure uniform bond. Remove adhesive promptly from face of carpet.

3.04 CLEANING

- A. Remove debris, sorting pieces to be saved from scraps to be discarded.
- B. Clean new carpet thoroughly with a high-efficiency particulate air (HEPA) filtration vacuum.

C. Remove spots and replace carpet where spots cannot be removed.

3.05 PROTECTION

A. Contractor to use protection methods and materials needed to ensure that carpeting will be without deterioration or damage at time of substantial completion.

END OF SECTION

SECTION 09.700 PRESENTATION DRY ERASE WALLCOVERING

PART 1 GENERAL

1.01 SUMMARY

A. Division Includes:

1. Projection Dry Erase Wallcovering.
2. Tray, Trim, and Presentation Rails.
3. Accessories.

B. Related Divisions:

1. Division 09.255 Gypsum Board Assemblies

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

- E84 Test Method for Surface Burning Characteristics of Building Materials.

B. Gypsum Association

- GA-214-M-9 Recommended Levels of Gypsum Board Finish.

1.03 SUBMITTALS

A. Manufacturer's product data and installation instructions for each type of dry erase wallcovering, adhesive, and accessories required.

B. Manufacturer's written product data indicating compliance with specified materials required.

C. Manufacturer's written installation instructions.

D. Manufacturer's written instructions for recommended maintenance of each type of dry erase wall covering required.

E. Samples:

1. 7 inch (177.8mm) x 9 inch (228.6mm) samples of each dry erase material required.
2. 6 inch (152.4mm) samples of trim, tray, and end caps required.

1.04 QUALITY ASSURANCE

A. Manufacturer: Provide each type of dry erase wallcovering required produced by one manufacturer.

B. Installer: Installation by skilled commercial wallcovering contractor with no less than three years of documented experience installing dry erase wallcovering of the types and extent required.

- C. Composition
 - 1. Basis of Design: Matte-rite: White, Non-woven, Dry Erase Writing and Projection Surface.
 - 2. Approved Equal.
- D. Surface Burning Characteristics Classification: Provide materials that meet Class I/A rating when tested in accordance with ASTM E84 for flame spread and smoke developed.
- E. Field Samples: Prepare field samples for architect's review and establish requirements for seaming and finish trim.
 - 1. Install sample panel of each type presentation wallcovering specified in area designated by architect.
 - 2. Maintain corrected and approved samples to serve as a standard of performance for the project.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver presentation wallcoverings to the project site in unbroken and undamaged original factory packaging and clearly labeled with the manufacturer's identification label, quality or grade, and lot number.
- B. Store materials in a clean, dry storage area with temperature maintained above 55°F (13°C) with normal humidity.
- C. Store material within original packaging to prevent damage.

1.06 PROJECT CONDITIONS

- A. Do not apply presentation wallcoverings when surface and ambient temperatures are outside the temperature ranges required by the wallcovering manufacturer.
- B. Provide continuous ventilation and heating facilities to maintain substrate surface and ambient temperatures above 55°F (13°C) unless required otherwise by manufacturer's instructions.
- C. Apply adhesive when substrate surface temperature and ambient temperature is above 55°F (13°C) and relative humidity is below forty percent.
- D. Maintain constant recommended temperature and humidity for at least 72 hours prior to and throughout the installation period, and for 72 hours after wallcovering installation completion.

PRESENTATION DRY ERASE WALLCOVERING

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E. Provide not less than 80-foot-candles per square foot lighting level measured mid-height at substrate surfaces.

1.07 WARRANTY

A. Submit manufacturer's limited five-year written warranty against manufacturing defects.

1.08 MAINTENANCE

A. Maintenance instructions: Include precautions against cleaning materials and methods that may be detrimental to finishes and performance.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Basis of Design: Wallcoverings: Walltalkers Wallcoverings manufactured by Koroseal Interior Products, LLC., Fairlawn, Ohio.

B. Approved Equal.

2.02 MATERIALS

A. Walltalkers nu•vu•rite: Patented bi-directional lenticular embossed vinyl surface for projection and dry erase markers. Patent # 5,361,164.

2. NV60: 59/60 inch (1.50/1.52m) width, non-woven backing.

2.03 TRIM & TRAY

A. Aluminum Tray

1. TYXX-00=04, 08, 12 for length. Clear satin, anodized aluminum, snap-on marker and eraser tray with Clips.

B. Aluminum Trim

1. TMXX-00" XX-04, 08, 0r 12 for length. Clear satin, anodized aluminum, snap-on trim with clips

C. End Caps

1. ET02-00: 1/4 inch (6mm) box tray end cap set for marker and eraser tray.

2. ET03-00: 1/2 inch (13mm) anodized tray end cap set for marker and eraser tray.

D. J Cap Wallcovering Trim

1. JC12-00: Clear satin, anodized aluminum, low profile trim.

PRESENTATION DRY ERASE WALLCOVERING

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- E. Plastic Marker Dispenser
 - 1. PMD1-99: Black plastic marker dispenser.
- F. Paper Rail
 - 1. PR12-00: Aluminum Paper Rail.
- G. Tack Rail
 - 1. T212-ZZ: ZZ=color 2 inch (51mm) tack rail with tac•wall insert.

2.04

ACCESSORIES

- A. Adhesives: Heavy-duty clear or clay based premixed vinyl adhesive.
- B. Substrate Primer/Sealer: White pigmented acrylic base primer/sealer specifically formulated for use with vinyl wallcoverings.
- C. Presentation Starter Kit: Provide one Walltalkers starter kit containing eight dry erase markers, one eraser, two dry erase cleaning cloths, one empty bottle for water, and one 8 ounce (.23kg) bottle liquid surface cleaning solution for each room installed with dry erase wallcovering.
 - 1. RK1RSK2: Regular starter kit with standard dry erase markers.
- D. Broad Tip Dry Erase Markers
 - 1. EC12-99: Chisel BLK - 12CT
 - 2. EC04-00: Set of four colors: red, blue, green, black.
- E. Eraser
 - 1. DEFE-99: Dry erase felt eraser.
 - 2. DECC-Y1: Dry erase cleaning cloth - yellow.
- F. Liquid Surface Cleaner
 - 1. RCC8: 8 ounce (.23kg) bottle liquid surface cleaner.
- G. Magnets
 - 1. MAG1: Heavy duty magnet - black.
- H. Wood Shelf Caddy: Provide 12 inch (304.8mm) high x 7-5/8 inch (193.7mm) wide wood caddy with four shelves spaced 1-3/4 inch (4.4mm) apart for storing markers and erasers.
 - 1. WSC1-M3: Maple wood shelf caddy, cherry stain.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and installation conditions to ensure surface conditions meet or exceed a Level 4 finish, per GA-214-M-97: Recommended Levels of Gypsum Board Finish, and permanent lighting should be installed and operational.
- B. Test substrate with suitable moisture meter and verify that moisture content does not exceed four percent.
- C. Verify substrate surface is clean, dry, smooth, structurally sound, and free from surface defects and imperfections that would show through the finished surface.
- D. Evaluate all painted surfaces for the possibility of pigment bleed-through.
- E. Notify the contractor and architect in writing of any conditions detrimental to the proper and timely completion of the installation.
- F. Beginning of installation means acceptance of surface conditions.

3.02 INSTALLATION Wallcovering backing.

- A. Acclimate wallcovering in the area of installation a minimum of 24 hours before installation.
- B. Read and follow the manufacturer's installation instruction sheet contained in each roll of the dry erase wallcovering.
- C. Examine all materials for pattern, color, quantity and quality, as specified for the correct location prior to cutting.
- D. Primer: Use a quality pigmented acrylic wallcovering primer.
- E. Adhesive: Apply a uniform coat of heavy-duty pre-mixed clay-based or extra strength clear wallcovering adhesive.
- F. Install each strip horizontally and in the same sequence as cut from the roll.
- G. Install dry erase wallcovering sheets in exact order as they are cut from bolt. Reverse hang alternate strips (except lined products). Do not crease or bend the wallcovering when handling.
- H. Install dry erase wallcovering horizontally using a level line.

PRESENTATION DRY ERASE WALLCOVERING

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- I. Using a level or straight edge, double cut the seam with a seam-cutting tool (Ex: Double Seam-Cutter or Swedish Knife). Do not score drywall or plasterboard when cutting material.
- J. When covering the entire wall, seam the material out of the main writing and viewing areas of the wall.
- K. Apply wallcovering to the substrate using a wallcovering smoother, wrapped with a soft cloth, to remove air bubbles. Do not use sharp edged smoothing tools. Smooth material on the wall from the middle to the outside edge.
- L. Remove excess adhesive immediately after the wallcovering is applied. Clean entire surface with a warm mild soap solution, and clean soft cloths. Rinse thoroughly with water and let dry before using. Change water often to maintain water clarity.
- M. Stop installation of material that is questionable in appearance and notify the manufacturer's representative for an inspection.

3.03 INSTALLATION Self-adhesive backing.

- A. Apply Walltalkers adhesive backed dry erase wallcovering only on surfaces impervious to moisture such as chalkboards, marker boards, glass, high-pressure laminates, or similar.
- B. Acclimate wallcovering in the area of installation a minimum of twenty-four hours before installation.
- C. Examine all materials for color, quantity, and quality as specified for the correct location prior to cutting.
- D. Read and follow the instructions in the manufacturer's installation sheet contained in each roll of the dry erase wallcovering.
- E. Do not crease or bend the wallcovering when handling.
- F. Mix dampening solution by using one half to one capful of mild detergent to 1 gallon (1.81kg) clean water. Dampening solution is used in positioning the material and allows for the removal of air bubbles.
- G. Use a pump spray bottle to apply the dampening solution to the the surface.
- H. Slowly remove release liner and smooth wall covering to the hanging surface using a wallcovering smoother wrapped with a soft cloth from the middle to the outside edge to remove air bubbles.

- I. Stop installation of material that is questionable in appearance and notify the manufacturer's representative for an inspection.

3.04 CLEAN-UP

- A. Upon completion of installation, remove all exposed adhesive immediately using a soft cloth and a warm, mild soap solution and rinse thoroughly with water and dry with clean towel prior to using.
- B. Upon completion of the work, remove surplus materials, rubbish, and debris resulting from the wallcovering installation. Leave areas in neat, clean, and orderly condition.

END OF SECTION

SECTION 09.720 THIN SET EPOXY TERRAZZO FLOORING SYSTEM
WITH CRACK BRIDGING MEMBRANE

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnish necessary material, labor, and equipment required to prepare designated areas and install a Thin-set Epoxy Terrazzo Flooring System, complete with integral terrazzo coved base, and zinc dividing strips, along with a full coverage crack membrane and full coverage moisture barrier.
- B. Types of terrazzo include:
 - 1. Precast terrazzo (wall and column bases, stair treads, risers stringers and landings)
 - 2. Thin set epoxy terrazzo flooring (floor slabs).

1.02 RELATED WORK

- A. Drawings and general provisions of contract including General and Special Conditions and Division 1, excepting special Submittal and Quality Assurance provisions in this section.

1.03 QUALITY ASSURANCE

A. MANUFACTURER'S QUALIFICATIONS

- 1. Obtain Thin-set Epoxy Terrazzo Flooring System materials from a single manufacturer with a minimum of five (5) years verifiable experience providing materials of the type specified in this section.

B. CONTRACTOR'S QUALIFICATIONS

- 1. Installation must be performed by a manufacturer certified contractor with skilled mechanics having not less than three years satisfactory experience in the installation of the type of system as specified in this section, and must be certified in writing by the manufacturer of the Thin-set Epoxy Terrazzo Flooring System. Contractor must be in good standing with the National Terrazzo Mosaic Association (NTMA) and have at least three projects of comparable scope and complexity and of at least 50% total square footage of this project.

C. FLOOR SYSTEM THICKNESS VERIFICATION

- 1. At the Owner's discretion and under his supervision the contractor shall take six (6) 1"

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random cores per 1,000 sq. ft. through the system into the substrate to verify proper system thickness. Cored areas less than specified thickness shall be removed and replaced or increased in thickness by the installing contractor, in a manner that does not affect the performance or integrity of the system. Cored areas which comply with the recommended system thickness shall be built-up to match the surrounding surface elevation prior to applying the seal coats. Cores taken and patched will be noticeable; therefore, cores should be taken from areas where aesthetics are less critical. Cost associated with repair of cored areas that comply with specification thickness are the responsibility of the Owner.

1.04 WARRANTY

- A. The contractor and the manufacturer shall furnish a standard guarantee of the Thin-set Epoxy Terrazzo Flooring System for a period of one year after installation. The labor and material guarantee shall include loss of bond and wear-through to the concrete substrate from normal use.
- B. Not included in the warranty are damage due to structural design deficiencies including by not limited to slab cracking from lateral, vertical or rotational movement, and gouging or other damage due to fork lifts, other equipment, delamination caused by vapor transmission, Acts of God, or other elements beyond the scope of protection of this system nor causes not related to the system materials.
- C. In case of a warranty claim, the Owner will notify the manufacturer and contractor in writing within 30 days of the first appearance of problems covered under this warranty. The Owner will provide free and unencumbered access to the area during normal working hours for warranty rework. Property protection is also the Owner's responsibility. Remedy is limited to direct repair of the Thin-set Epoxy Terrazzo Flooring System.

1.05

SUBMITTAL

A. SYSTEM DATA

1. Submit manufacturer's specifications on cured system and individual physical properties and performance properties and tests described in part 2.01 B and submit Material Safety Data Sheets. Each individual component of the system will be evaluated on the basis of these standards. For any tests not listed in the manufacturer's standard nationally published data, the manufacturer must supply the missing data accompanied by the independent testing laboratory's test results which prove compliance in accordance with the referenced standard(s). Furnish five (5) sets of this information. Manufacturer's standard color chart shall also be submitted and must afford the Owner color selection from at least nine (9) standard colors and computerized custom color matching shall be available upon request. Furnish two (2) sets of physical samples.

B. The contractor shall submit a 6"x 6" cured system sample which the contractor has made for verification purposes and finish texture approval.

C. CONTRACTOR EXPERIENCE

1. The contractor shall furnish a list of projects using either specified material of equivalent that they have installed during the last five (5) years. Information shall include: project name, square footage, Owner contact name with Owner's address and phone number. Also, the contractor shall furnish resumes detailing the experience of key project personnel including supervisors and mechanics.

D. It is the intention of this Section to provide the products as named. Substitutions will be considered only when received by the Architect, through a bidding Prime Contractor at least ten days prior to the date set for receipt of bids. No substitutions will be considered after contract bid date.

E. The contractor shall submit a copy of the manufacturer's packing slip, tagged for this specific job, along with calculations, signed by an officer of the primary material supplier demonstrating that the quantity of material

THIN-SET EPOXY TERRAZZO FLOORING

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furnished for the project will achieve the specified coverage and mil thickness.

1.06 MATERIAL DELIVERY, HANDLING AND STORAGE

- A. Primary system materials shall be delivered in the manufacturer's undamaged, unopened containers. Each container shall be clearly marked with the following:
 - 1. Product name(s) and /or Number(s)
 - 2. Manufacturer's name
 - 3. Component designation (A, B, etc,)
 - 4. Product Mix Ratio
 - 5. Health and Safety Information
 - 6. CHEMTREC Emergency Response Information
- B. Provide equipment and personnel to handle the materials by methods which prevent damage.
- C. The contractor shall promptly inspect direct jobsite material deliveries to assure that quantities are correct, comply with requirements and are not damaged.
- D. The contractor shall be responsible for materials furnished by him, and he shall replace, at his own expense, such materials that are found to be defective in manufacture or that have become damaged in transit, handling or storage.
- E. Store material(s) in accordance with manufacturer's instructions, with seals and labels intact and legible. Maintain temperatures within the required range. Do not use materials which exceed the manufacturer's maximum recommended shelf life.

1.07 JOB CONDITIONS

- A. The contractor shall visit the jobsite prior to the installation of the Thin-set Epoxy Terrazzo Flooring System to evaluate substrate condition, including substrate moisture transmission, quantity and severity of cracking, and the extent of repairs needed. Substrate imperfections should be repaired only after mechanical preparation of the substrate. Surface preparation reveals most imperfections requiring repair. Concrete substrates shall be tested to verify that the moisture vapor transmission of the substrate does not exceed the Thin-set Epoxy Terrazzo Flooring System manufacturer's recommendations. Cost associated with repair, leveling and remediation of the substrate are the responsibility of the provider

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of the substrate; except that correction of substrate moisture transmission shall be the responsibility of the Thin-Set Epoxy Terrazzo installer.

- B. The contractor should exercise care during surface preparation and system installation to protect surrounding substrates and surfaces, as well as in-place equipment. The contractor shall prepare the substrate to remove laitance and open the surface. This shall be achieved by light brush grit blasting. Surface profile achieved shall be similar to medium grit sandpaper and free from bond-inhibiting contaminants.
- C. Sub floor tolerances are specified in Section 03.300 (in accordance with ACI 302). Each drain in the installation area must be working and raised or lowered to the actual finished elevation of the Thin-set Epoxy Terrazzo Flooring System.
- D. System must be protected by the General Contractor or, as a separate bid item, by the installing contractor until it is inspected and turned over to the Owner.
- E. The minimum slab temperature must be conditioned to 60 degrees F before commencing installation, during installation, and for at least 72 hours after installation is complete. The substrate temperature must be at least 5 degrees F above the dew point during installation.
- F. Maintain lighting at a minimum uniform level of 50 or more foot candles in areas where the Thin-set Epoxy Terrazzo Flooring System is being installed. It is the recommendation of the manufacturer that the permanent lighting be in place and working during the installation.
- G. Leaks from pipes and other sources must be corrected prior to the installation of the Thin-set Epoxy Terrazzo Flooring System.

PART 2 PRODUCTS

2.01 MATERIALS

A. APPROVED MANUFACTURERS AND SYSTEMS

- 1. General Polymers; #1100 Epoxy Thin-set Terrazzo System with Crack Bridging Membrane.
- 2. Master Terrazzo Technologies, LLC; Morricite Thin-Set Epoxy Terrazzo over MasterFlex Membrane.

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3. Other manufacturers and systems, as approved by the Architect.

B. SYSTEM OVERVIEW: The Thin-set Epoxy Terrazzo Flooring System shall be #1100 Epoxy Thin-set Terrazzo System with FlexGrid Crack Bridging Membrane, consisting of 3556 EPO-FLEX Terrazzo Membrane, FS38-4.4 Fiberglass Scrim, 3520 Epoxy Terrazzo Matrix as the binder resin, 5270 Epoxy Filler, #0, #1 and #2 Marble Chips, 3520 Epoxy Terrazzo Matrix with 5271 Terrazzo Grout Additive as Grout and 4540 Acrylic Polyurethane Floor Sealer as the seal coats. The total system thickness will be 3/8" nominal.

C. TYPICAL PHYSICAL PROPERTIES @ 73 DEGREES F (UNLESS OTHERWISE NOTED)

1. Typical Physical Properties

Binder Resin

Color Any custom color matching available upon request
Able to match NTMA and TTMAC, Standard color plates.

Hardness, @ 24 hours 85/65
Shore D
ASTM D 2240

Compressive Strength 10,000 psi 68.9 MPa

Tensile Strength 3,000 psi 20.7 MPa
ASTM D 638

Flexural 4,500 psi 31.0 MPa
ASTM D 790

Flexural Modulus 500,000 psi 3445 MPa
ASTM D 790

2. Typical Physical Properties Continued

Adhesion 350 psi 2.4 Mpa
ACI 503R 100% concrete failure

Abrasion Resistance 70-90 milligrams lost
ASTM D 4060

Water Absorption .1%
ASTM D 570

3. SYSTEM

Critical Radiant Flux .90
ASTM D 648

Indentation None
MIL -D-3134J

Impact Resistance Withstands 16 ft-lbs
MIL -D-3134, Sec,4.7.3. without cracking,
delamination or
chipping

Resistance to Elevated No slip or flow at
Temperatures required temperature
MIL -D-3134J of 158 degrees F

Slip Resistance Meets ADA Standards
(sealer) with a
minimum coefficient
of friction of 0.60.

Thermal Coefficient of 25x10⁻⁶ in/in/degrees
Expansion
ASTM D 696

ASTM C = Mortar System
ASTM D = Resin only

D. Precast Terrazzo. Comply with NTMA specifications and recommendations for fabrication of precast terrazzo. Reinforce precast terrazzo units as required. Match color and pattern of precast work with color and pattern of the flooring terrazzo.

E. DIVIDING STRIPS

1. Floor divider strips shall be zinc with 1/8" thick vertical leg.

- F. MOISTURE-REDUCTION BARRIER (as required)
 - 1. Shall be as required to reduce the moisture vapor transmission of the substrate to that it does not exceed the flooring manufacturer's recommendations.
 - 2. Contractor shall verify that the Moisture-Reduction Barrier is compatible with the finish floor.
- G. COLORS
 - 1. Terrazzo colors are to be selected by Architect from NTMA standard formulations.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

- A. For thorough instructions regarding preparation of concrete substrates consult "Instruction for Concrete Surface Preparation" (Form G-1).
- B. Apply Moisture-Reduction Barrier, as required, in strict accordance with the manufacturer's recommendations.

3.02 INSTALLATION

A. GENERAL

- 1. Apply each component of the Thin-set Epoxy Terrazzo Flooring System in compliance with manufacturer's written installation instructions and strictly adhere to mixing and installation methods, recoat windows, cure times and environmental restrictions. The Thin-set Epoxy Terrazzo Flooring System is to be installed directly over non-moving control joints and cracks which have been treated with EPO-FLEX epoxy, and the Thin-set Epoxy Terrazzo Flooring System will terminate at the edge of isolation and expansion joints as designated by the Architect, Engineer or Design Professional. Integral cove base shall be installed where specified in drawings.

B. CRACKS

- 1. After preparation, evaluation of quantity and severity of cracks in concrete will determine the needed repairs. For information pertaining to the

treatment of cracks in concrete substrates, consult Manufacturer's publication, Concrete 102.

C. CONTROL JOINTS

1. For information pertaining to the treatment of control joints in concrete substrates, consult Manufacturer's publication, Concrete 103.

D. ISOLATION/EXPANSION AND OTHER JOINTS SUBJECT TO MOVEMENT

1. All expansion joints must be honored through the flooring system. For information pertaining to the above, consult Manufacturer's publication, Concrete 105.

E. MEMBRANE

3556 EPO-FLEX Terrazzo Membrane
FS38-4.4 oz Fiberglass Scrim

F. DIVIDER STRIPS

1. Install divider strips in 30"x30" grid, at toe of cove base, at 60" on centers along cove base, and inverted along top of cove base. Layout of divider strips to be coordinated with Architect prior to installation.

G. MORTAR INSTALLATION

3520 Epoxy Terrazzo Matrix as the binder resin 5270 Epoxy Filler #0, #1 and #2 Marble Chips.

H. GROUT COAT

3520 Epoxy Terrazzo Matrix
5271 Terrazzo Grout Additive

I. Cleaner: Liquid, neutral chemical cleaner, with Ph factor between 7 and 10 of formulation recommended by sealer manufacturer for type of terrazzo used, and complying with NTMA requirements.

J. Interim Floor Sealer: U.L. listed colorless, slip and stain resistant penetrating sealer with Ph factor between 7 and 10, which will not affect color or physical properties of terrazzo surface.

3.03 CURING, CLEANING AND PROTECTION

A. Cure the Thin-set Epoxy Terrazzo Flooring System materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of the installation and prior to completion of the curing process.

B. Protect the Thin-set Epoxy Terrazzo Flooring System from damage and wear during other phases of the construction operation, using temporary coverings as

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- recommended by the manufacturer, if required. Remove temporary covering just prior to final inspection.
- C. Clean the Thin-set Epoxy Terrazzo Flooring System just prior to final inspection, using materials and procedures suitable to the system manufacturer.
 - D. Provide written detailed floor maintenance instructions to the Owner.

END OF SECTION

SECTION 09.750 GRAPHIC WALL COVERING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Custom printed self-adhesive wall covering.

B. Related Sections:

1. Division 1: Administrative, procedural and temporary work requirements.

1.02 REFERENCES

A. Wall coverings and their installation shall comply with applicable provisions of the latest edition of the following standards and with requirements of authorities having jurisdiction:

1. National Fire Protection Association 101 Life Safety Code.
2. ASTM - American Society for Testing and Materials E84.

1.03 SUBMITTALS

A. Submittals for Review:

1. Panel schedule in manufacturer's format for verification of graphic image and copy.
2. Approval drawings showing materials, print detail, lay-out, size, graphic and installation method.
3. Elevation drawings.

1.04 QUALIFICATIONS

A. Manufacturer specializing in manufacturing the products specified in this section with minimum 5 years experience. Obtain from one source and a single manufacturer.

1.05 WARRANTY

A. Provide manufacturer's warranty against defects in materials and workmanship for minimum 5 years.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Wall coverings shall be Soul, Class A, Fire Rated as manufactured by Takeform, 1.800.528.1398, www.takeform.net or Architect approved equal.

B. Substitutions: Bidder must obtain prior written approval from the Architect and/or Owner to bid alternates or substitutions to the specification. Any request for substitutions must be accompanied by a listing of the specific points of deviation.

2.02 STANDARDS

A. Color and Finishes:

1. Colors, patterns and artwork: see drawings.
2. Graphic Background: see drawings.
3. Finishes are to meet current federal ADA and all state and local requirements.

2.03 WALL COVERINGS

A. Wall coverings:

1. Wall coverings shall be self-adhesive intended for indoor use on smooth surfaces.

B. Materials:

1. Wall coverings shall be 100% polyester fabric, coated on one side with a removable and repositionable acrylic pressure sensitive adhesive and 90# polycoated liner. Wall covering shall have a thickness of 7 mil.
2. Wall coverings shall be printed with latex ink.
3. Wall coverings shall have an ASTM E84 Class A/1 flame spread file rating.
4. Wall coverings shall resist mild alkalis, mild acids, salt and water.
5. Wall coverings shall be cleanable using mild dish soap and water.

C. Colors, Patterns and Artwork:

1. Refer to drawings.

D. Film Size:

1. Refer to drawings.

E. Quantities:

1. Refer to drawings.

2.04 INSTALLATION METHOD

A. Wall covering shall be allowed to normalize to room conditions for 48 hours prior to installation. Wall surface shall be flat, smooth, clean and dry. Wall surface imperfections must be repaired and smoothed. Walls shall be primed and sealed.

B. Wall covering shall be butt seamed.

PART 3 EXECUTION

3.01 SITE VISITS

- A. Site visits - 3 site visits shall be required by the sign contractor:
1. Prior to submission of bid for site assessment and evaluation.
 2. Post award for the purposes of meeting with Owners and project manager.
 3. Final walk-through and punchlist.

3.02 DELIVERY, STORAGE, PROTECTION

- A. Package to prevent damage or deterioration during shipment, handling, storage and installation. Products should remain in original packaging until removal is necessary. Store products in a dry, indoor location.

3.03 EXAMINATION

- A. Installer shall examine panels for defects, damage and compliance with specifications. Installation shall not proceed until unsatisfactory conditions are corrected.

3.04 INSTALLATION

- A. General: Installation locations shall be in accordance with specifications. Locate where indicated using installation methods in compliance with manufacturer's written instructions:
1. The contractor shall coordinate installation schedules with the Owner and/or Construction Manager.
 2. Installation shall be performed by manufacturer's personnel trained and certified in manufacturer's methods and procedures.
 3. The contractor shall submit a CAD generated location plan noting the location of all graphic panels.
 4. Panels shall be level, plumb, and at locations indicated with surfaces free from defects.
 5. Upon completion of the work, contractor shall remove unused or discarded materials, containers and debris from site.

END OF SECTION

GRAPHIC WALL COVERING

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SECTION 09.770 MODULAR WOOD WALL PANEL SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Scope: Section includes, but is not limited to, interior architectural modular wall system including trims, terminations, miscellaneous metal and sub-frames, clips, fasteners and other devices for secure anchorage of panels to conventional drywall or other substrate provided for this purpose.
- B. Related Sections
 - 1. Section 09.255 Gypsum Board Assemblies
 - 2. Section 14.210 Electric Traction Elevators

1.02 SUBMITTALS

- A. Shop Drawings: Submit complete shop drawings indicating quantities, finishes, dimensions and attachment relationships.
- B. Product Data: Submit manufacturer's product data, specifications and installation instructions.
- C. Samples: Submit color and finish samples to determine range of texture and consistency of color and finish expected in the finished work. Standard sample size shall be 3" x 3".

1.03 QUALITY ASSURANCE

- A. Manufacturer shall have a minimum of five years experience in manufacturing architectural materials.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver components in clearly marked containers and packages suitable for shipment of specified products so as to prevent finish damage in transit.
- B. Store components only in secured ambient environment (humidity min. 25% - max 55%, temperature not to exceed 80 degrees). Store in dry locations that will avoid damage from job-site traffic, moisture, stacking of materials and other job-site contamination. Do not stack panels directly on floor. Do not subject panels to moisture.
- C. Handle components to avoid racking, twisting, denting or scratching of finished surfaces.

1.05 WARRANTY

- A. Provide manufacturers' warranty against defects in material and workmanship for a period of one year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

Basis of Design: Graph Modular Wall System

- A. Fry Reglet Corporation
- B. Rulon
- C. 9Wood

2.02 MATERIALS

- A. Framing Assemblies: Framing components to be fabricated from extruded 6063 T5 aluminum. Finishes: Standard anodized finish Architectural 200R1 medium etch (AA-M32c10A21), clear anodized color. Framing components to be fabricated from extruded 6463 T5 aluminum. Intermediate Fin Type: Double Fin (1/4" Reveal). Outside Corner Type: .375" x .375" "X" Corner.
- B. Infill Panel Substrate and Veneer
Substrate: 3/4" medium density fiberboard (MDF), 48# density, minimum internal bond strength of 120# SI. Class A.
Veneer: Architectural grade quarter cut veneer (.035" thick) applied to the substrate via cold press with balancing backer sheet.

2.03 FABRICATION

- A. Aluminum framing components to be factory mitered and welded to form subassemblies of 2-way, 3-way and 4-way intersections, inside and outside corners and custom intersections as detailed in manufacturer's shop drawings. Modular wall system shall be capable of providing a Double Fin (1/4" reveal)
- B. Reveal joint with an anodized aluminum exposed element bordering each panel horizontally, vertically or in both directions in accordance with Architectural drawings. All other details, including base, head, corners, intersections etc. shall be fabricated in accordance with the Architectural drawings.

- C. Infill panels shall be installed in a non-progressive manner and must be point accessible. Panels shall be affixed to framework with co-extruded clips having an independent lab certification pullout loading of 10 pounds per inch of attachment.

PART 3 EXECUTION

3.01 PREPARATION

- A. Examine job-site conditions to verify that walls to receive the modular wall system are dry, flat and rigid. Recommended stud spacing 16" or 24" o.c. Framing must conform to ML/SFA 540 specification:
 - 1. Vertical alignment (plumbness) of walls shall be within 1/960th (1/8" in 10 feet) of the span
 - 2. Horizontal alignment (levelness) of walls shall be within 1/960th (1/8" in 10 feet) of their respective heights.
 - 3. Squareness of walls shall be not more than 1/8" out of square within the length of that wall.
- B. Climate control: Material must be stored, installed and maintained only in secured ambient environment (*humidity min. 25% - max 55%, temperature not to exceed 80 degrees*)
- C. Verify dimensions of wall panels prior to installation to assure compatibility with job-site conditions.

3.02 INSTALLATION

- A. Install grid components in accord with manufacturer's installation instructions and approved shop drawings. Grid components must be plumb, true and level as described in 3.1.A.
- B. All panels with a wood substrate must be allowed to acclimate to the project environmental conditions prior to installation. Refer to manufacturer's acclimatization Instructions for complete information.
- C. Wall panels shall be erected plumb, level, square, true to line, securely anchored and in proper alignment and relationship to work of other trades.

3.03 CLEANING AND PROTECTION

A. Visually inspect all exposed surfaces for scratches or blemishes. Protection of wall panels from damage by other trades after installation shall be the responsibility of the General Contractor.

END OF SECTION

SECTION 09.800 ACOUSTICAL TREATMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes the following in locations where indicated on Drawings:
1. Acoustical wall panels.

1.02 REFERENCES

- A. ASTM C 423 -Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2000.
- B. ASTM E 84 -Standard Test Method for Surface Burning Characteristics of Building Materials; 2000a.

1.03 PERFORMANCE REQUIREMENTS

- A. Acoustical Absorption: Perform testing in accordance with ASTM C 423, Type A mounting method unless otherwise specified.
1. Flame Spread Rating: Provide all components with Class A flame spread rating when tested in accordance with ASTM E 84, unless otherwise specified.

1.04 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.
 4. Independent testing agency test reports.
- B. Selection Samples: For each product specified, two complete sets of color samples representing manufacturer's full range of available colors and patterns.
- C. Verification Samples: For each product specified, two samples, minimum size 6 inches square, representing actual product, color, and patterns.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 10 years of experience in producing acoustical products of the types specified herein.

B. Installer Qualifications: Acceptable to the manufacturer of the acoustical products being installed.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect acoustical products from moisture during shipment, storage, and handling.
- B. Store products in manufacturer's unopened packaging until ready for installation.
 - 1. Store materials flat, in dry, well-ventilated space.
 - 2. Do not stand panels on end.
 - 3. Protect edges from damage.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 PROJECT CONDITIONS

- A. Do not begin installation of acoustical products until building has been enclosed and environmental conditions approximate those that will prevail when building is occupied.
- B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. G&S Acoustics
- B. Armstrong World Industries (Soundsoak)
- C. Acoustical Resources, Inc. (200B)
- D. Sound Concepts (Reflect Custom)

2.02 ACOUSTICAL WALL PANELS

- A. Wrapped Fiberglass Panels: "Acousti-Tack ATF", as manufactured by G&S Acoustics.
 - 1. Core of 6 to 7 pcf single fiberglass with chemically hardened edges, seamless finish material wrapped and bonded to back side of panels.
 - 2. Thickness: 1 inch; NRC 0.85.
 - 3. Size: As indicated on drawings.

4. Finish Material
 - a. Fabric and Color: as selected by Architect from G&S Acoustics full line of available fabrics.
5. Corners: Square.
6. Mounting: Adhesive.

2.03 ACCESSORIES

- A. Mounting Adhesive: Water-based, heavy-bodied adhesive (low or no VOC) as recommended by manufacturer of acoustical panels.
- B. Two-Part Z-clips: Manufacturer's standard mounting bar and matching clips for mounting on rear of acoustical panels.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Adhesive Mounting: Size back of panels at 18 inch on center in both directions with thin coating of adhesive in 4 inch squares. Center adhesive dabs the size of a large egg on each sized area, and press panel firmly against substrate, flattening adhesive. Block panel for not less than 24 hours until adhesive has set.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

ACOUSTICAL TREATMENT

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SECTION 09.900 PAINTING

PART 1 GENERAL

1.01 SUMMARY

- A. Extent of painting work is shown on drawings and schedules, and as herein specified.
- B. The work includes painting and finishing of new interior and exterior exposed items and surfaces throughout project and backpriming of finish woodwork and cabinets, except as otherwise indicated.
 - 1. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.
 - 2. Field painting of exposed bare and covered pipes (including color coding) and ducts, steel and iron work and primed metal surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated, is included.
- C. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, varnishes, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
- D. Following categories of work are not included as part of field-applied finish work, or are included in other sections of these specifications.
 - 1. Shop Priming
 - a. Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, steel joists, metal fabrications, hollow metal work, and similar items. Also, for factory built mechanical and electrical equipment or accessories.
 - 2. Pre-finished Items
 - a. Unless otherwise indicated, do not include painting when factory-finishing or installer finishing is specified for such items as (but not limited to) windows, plastic laminate, acoustical materials and finished mechanical and electrical equipment, including light fixtures.

3. Concealed Surfaces
 - a. Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, furred areas, pipe spaces, and duct shafts.
 - b. Backprime finished woodwork and cabinets. Use primer specified for exposed surfaces.
4. Finished Metal Surfaces
 - a. Metal surfaces of anodized aluminum, stainless steel, chromium plate, bronze and similar finished materials will not require finish painting, unless otherwise indicated.
5. Operating Parts and Labels
 - a. Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting, unless otherwise indicated. 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.
6. Do not paint concrete or floors, unless specifically indicated.
7. Gypsum wallboard joint preparation is included in Gypsum Wallboard Section.

1.02 SUBMITTALS

A. Product Data

1. Provide manufacturer's printed product data on all coatings specified, including preparation and application instructions.

B. Selection Samples

1. Provide two sets of samples not less than one by two inches in size illustrating range of colors and textures available for each finishing product specified.

C. Verification Samples

1. Provide two samples of not less than six inches square illustrating selected color and texture for each finishing product specified.

1.03 QUALITY ASSURANCE

A. Job Sample

1. Prior to start of painting, paint full size field sample of each individual color scheduled on each respective substrate. Paint sample at site, where directed, of workmanship to be expected in the completed work. Obtain Architect's acceptance of the sample before start of work. If sample is accepted, the sample may become part of the finished project.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label and following minimum information:

1. Name or title of materials
2. Manufacturer's name
3. Thinning instructions
4. Application instructions
5. Color name and number

B. Store paint products in covered, ventilated area at minimum ambient temperature of 45 degrees F and maximum ambient temperature of 90 degrees F.

1.05 PROJECT CONDITIONS

A. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F. (10 Celsius) and 90 degrees F. (32 Celsius), unless otherwise permitted by paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F. (7 Celsius) and 95 degrees F. (35 Celsius), unless otherwise permitted by paint manufacturer's printed instructions.

C. 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.

D. 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

2.01 MANUFACTURERS

- A. Acceptable Manufacturers
 - 1. Benjamin Moore
 - 2. Sherwin-Williams Company
 - 3. Glidden Professional
- B. Unless otherwise specified for an individual product or material, supply all products specified in this section from the same manufacturer.

2.02 PAINT, GENERAL

- A. Material Compatibility
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - 1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - 2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - 3. Floor Coatings: VOC not more than 100 g/L.
 - 4. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - 5. Shellacs, Clear: VOC not more than 730 g/L.
 - 6. Shellacs, Pigmented: VOC not more than 550 g/L.
 - 7. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.

2.03 MATERIALS

- A. Latex Flat, Egg-Shell, Semi-Gloss, and Primer:
 - 1. Interior latex containing zero-VOC's. Provide one of the following:
 - a. Sherwin-Williams Company: ProMar200 Zero VOC

- b. Benjamin Moore: Natura Zero-VOC
- c. Glidden Professional: LifeMaster
- 2. Custom colorants shall be low-VOC and not increase emissions.
- B. Other products (alkyd, shellacs, etc) shall be submitted prior to use for approval by Architect in accordance with VOC content as specified herein.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that site environmental conditions are appropriate for application of coatings specified.
- B. Immediately prior to coating application, ensure that surfaces to receive coatings are dry.
- C. Ensure that moisture-retaining substrates to receive coatings have moisture content within tolerances allowed by coating manufacturer, using moisture measurement techniques recommended by coating manufacturer.
- D. Immediately prior to coating application, examine surfaces to receive coatings for surface imperfections and for contaminants which could impair performance or appearance of coatings, including but not limited to, loose primer, rust, scale, oil grease, mildew, algae, or fungus, stains or marks, cracks, indentations, or abrasions.
- E. Correct the above conditions and any other conditions which could impair performance or appearance of coatings in accordance with specified surface preparation procedures before proceeding with coating application.

3.02 PREPARATION

- A. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.
- B. Stains and Marks: Remove completely, if possible, using materials and methods recommended by coating manufacturer; seal with shellac or other coating acceptable to paint manufacturer stains and marks that might bleed through paint finishes which cannot be completely removed.
- C. Remove or protect hardware, electrical plates, mechanical grilles and louvers, lighting fixture trim, and other items not indicated to receive

coatings which are adjacent to surfaces to receive coatings.

- D. Remove mildew from impervious surfaces by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow substrate to thoroughly dry.
- E. For specific substrate preparation, see "Surface Preparation" at end of Section.
- F. Maximize ventilation during application and drying.
- G. Isolate area of application from rest of building.

3.03 APPLICATION

A. General

1. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited to substrate and type of material being applied. Do not use roller or spray for wood and plywood, or roller for metal, unless specifically approved by the Architect.
2. 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.
3. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces.
4. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.
5. Finish exterior doors on tops, bottoms and side edges same as exterior faces, unless otherwise indicated.
6. Sand lightly between each succeeding enamel or varnish coat.
7. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated. Spot prime any damaged areas.

B. Scheduling Painting

1. Apply first coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
2. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until

paint has dried to where it feels firm, does not deform, or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Minimum Coating Thickness

1. Apply materials at not less than manufacturer's recommended spreading rate, to provide a dry film thickness per coat as indicated, or if not indicated, as recommended by coating manufacturer.

D. Mechanical and Electrical Work

1. Painting of mechanical and electrical work is limited to those items exposed on the exterior of the buildings, including the roof, and in occupied spaces.
2. Mechanical items to be painted include, but are not limited to, the following (where present):
 - a. Piping and supports, roof vents, louvers, grilles, registers, fans and curbs.
3. Electrical items to be painted include, but are not limited to, the following (where present):
 - a. Conduit, boxes and fittings, exposed panelboard surfaces, including covers.

E. Prime Coats

1. Apply prime coat to material which is required to be painted or finished, and which has not been prime coated by others.
2. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

F. Pigmented (Opaque) Finishes

1. Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable. Cut in sharp lines and color breaks.

3.04 CLEANING

- A. During progress of work, remove from site discarded paint materials, rubbish cans and rags at end of each work day.
- B. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered

paint by proper method of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

- C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.
- D. Vacate space for as long as possible after application. Wait a minimum of 48 hours before occupying freshly painted rooms.

3.05 PROTECTION

- A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.06 SURFACE PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
- C. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

3.07 SCHEDULE

- A. If paint on walls is to be applied using spray technique, the final coat shall be backrolled to ensure even distribution.
- B. At all gypsum board ceilings and areas above 10'-0" aff, use a flat finish in lieu of scheduled paint.
- C. Paint all exterior metal - primed and/or galvanized (doors, frames, lintels, bollards, etc.) unless otherwise noted on Drawings.
- D. Paint all interior structural steel which is exposed to view whether called for on the Drawings or not. Paint all exposed ductwork and electrical conduit where exposed ceilings occur (use a flat finish in lieu of scheduled paint).

E. Paint / stain all millwork not to receive surfacing as indicated on Drawings. Coordinate with Division 6 Section "Finish Carpentry" and "Interior Architectural Woodwork".

END OF SECTION

SECTION 09.980 COATINGS FOR CONCRETE AND MASONRY

PART 1 GENERAL

1.01 SUMMARY

- A. Apply concrete sealer to exposed concrete floors as indicated on Finish Schedule.
- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in Place Concrete".
 - 2. Division 7 Section "Joint Sealants".

1.02 SUBMITTALS

- A. Product Data - Submit manufacturer's product specification, installation instructions and general recommendations for sealing.
 - 1. Include Material Safety Data Sheets.
 - 2. Color samples from manufacturers standard colors.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Materials shall be delivered in original sealed containers, clearly marked with supplier's name, brand name and type of material.
- B. Storage and Handling: Recommended material storage temperature is 75°F. Handle products to avoid damage to container. Do not store for long periods in direct sunlight.

1.04 PROJECT CONDITIONS

- A. Environmental Conditions
 - 1. Do not proceed with application of materials when substrate temperature is less than 50°F and not above 90°F. Maintain a minimum concrete temperature of 50°F for a minimum of 24 hours before, during and after installation.
 - 2. Do not apply materials unless surface to receive coating is clean and dry.
 - 3. Prepared concrete shall have a pH between 6 and 10.

1.05 WARRANTY

- A. Provide manufacturer's standard warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. H & C Concrete (Division of Sherwin Williams)

- B. PROSOCO
- C. Vexcon Chemicals

2.02 MATERIALS

- A. Cleaner/Degreaser: "Cleaner Degreaser" as manufactured by H & C Concrete.
- B. Etching Solution: "Etching Solution" as manufactured by H & C Concrete.
- C. Concrete Stain
 - 1. Provide "Concrete Stain Solid Color Water-based" as manufactured by H & C Concrete.
 - a. Finish: Low Luster
 - b. Vehicle Type: 100% Acrylic
 - c. VOC: 224 g/L
 - d. Volume Solids: 30 ± 2%
 - e. Weight Solids: 43 ± 2%
 - 2. Color: to be selected from manufacturer's full line, including tintable colors.

PART 3 EXECUTION

3.01 PREPARATION

- A. Newly poured concrete must be at least 28 days old. All concrete must be porous, clean, dry and free of grease, oil & any other contaminates.
 - 1. If areas require cleaning, use cleaner/degreaser following manufacturer's directions. If mold, mildew or fungus is present, kill and remove with a solution of one-cup household bleach to one gallon of water.
- B. All horizontal concrete surfaces MUST be etched with etching solution, following manufacturer's directions. After etching the surface should have the feel of 120-grit sandpaper.
- C. Do not apply the stain until all surfaces are porous and have been properly prepared.
- D. Concrete stain should be applied on to a dry surface where moisture content should not exceed 3lbs/1000 sq. ft. of surface (ASTM F710). Air, surface and material temperature must be between 50° and 90°F and at least 5°F above the dew point during and for 24 hours after application.
 - 1. Prepared concrete must have a pH level between 6 and 10.

3.02

APPLICATION

- A. Apply coatings in strict accordance with manufacturer's recommendations.
- B. Stir stain thoroughly before and during application.
 - 1. When using more than one container, intermix all containers together to ensure color uniformity.
- C. A minimum two coats is required. Apply with brush, roller or spray.
 - 1. First Coat: Apply first coat evenly, working in one direction. Allow to dry at least 2 hours before applying second coat.
 - 2 Second Coat: Apply second coat crosswise to the first coat.
- D. Allow 72 to 96 hours drying conditions before using the surface.

END OF SECTION

SECTION 10.100 VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.01 SUMMARY

A. Types of markerboards and tackboards shown on the Drawings and specified in this section include the following:

1. Factory framed porcelain on metal markerboards.
2. Factory framed fabric covered cork tackboards.

1.02 SUBMITTALS

A. Product Data: Provide technical data for materials specified. Include Material Safety Data Sheets, when applicable.

B. Shop Drawings: Provide shop drawings for each type of porcelain enamel markerboard and fabric-faced cork tackboard. Drawings should include dimensioned elevations and show all anchors, accessories, layout and installation details. Include sections of typical trim members.

C. Samples and color charts: Provide representative samples of face, core, backing and trim material to illustrate finish, color and texture, as required.

D. Manufacturer's Instructions: Provide Manufacturer's installation instructions.

1.03 QUALITY ASSURANCE

A. Manufacturer: Unless otherwise acceptable to Architect, furnish all markerboards and tackboards by one manufacturer for entire project.

B. Regulatory Requirements: Conform to applicable code for flame/smoke rating in fabric-faced cork tackboards in accordance with ASTM-E 84.

C. Operation and Maintenance: Provide Manufacturer's instructions regarding regular cleaning, stain removal, and relevant precautions.

D. Provide all porcelain enamel markerboards with a factory-installed protective covering designed to be removed after successful installation.

1.04 DELIVERY AND STORAGE

A. Delivery: Deliver materials in original, unopened, undamaged containers with identification labels intact.

- B. Storage: Store materials upright and in a way to ensure protection from exposure to harmful weather conditions.

1.05 WARRANTY

- A. Provide a written warranty that states the porcelain enamel markerboard writing surface is guaranteed the life of the building in which it is originally installed. The warranty covers markerboards that do not retain their original writing or erasing qualities, or exhibit crazing, cracking, flaking or staining.
- B. Provide a written warranty that states the vinyl-fabric-faced cork tackboards are guaranteed for one year against defects in materials and/or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Newline Products
- B. Claridge Products and Equipment
- C. Aywon Chalkboard

2.02 MATERIALS

- A. Porcelain Enamel Markerboards (MB): Balanced, high-pressure-laminated, porcelain enamel markerboards of three-ply construction consisting of face sheet, core material, and backing.
 - 1. Face Sheet: 0.024 inch (24 gauge) enameling grade steel especially processed for temperatures used in coating porcelain on steel. Coat exposed face and edges with a 3-coat process consisting of primer, ground coat, and color cover coat. Provide Manufacturer's standard writing surface with gloss finish intended for use with erasable dry markers. Fuse cover and ground coats to steel at Manufacturer's standard firing temperatures, but not less than 1200 degrees F.
 - 2. Core Material: 1/2" hardboard core material.
 - 3. Backing Sheet: 0.015-inch thick aluminum sheet panel.
 - 4. Laminating Adhesive: Manufacturer's standard moisture-resistant, thermoplastic type adhesive.
- B. Fabric-Faced Cork Tackboards (TB): Balanced, high-pressure laminated, fabric-faced cork tackboards of three-ply construction consisting of fabric face sheet, cork sheet core material, and backing.

1. Vinyl Fabric Face Sheet: Mildew-resistant, washable vinyl fabric complying with FS CCC-W-408, weighing at least 13-oz./sq. yd.
2. Cork Sheet Core Material: ¼-inch thick self-healing natural cork sheet.
3. Backing Sheet: ¼-inch thick hardboard.
4. Laminating Adhesive: Manufacturer's standard moisture-resistant, thermoplastic type adhesive.

2.03 ACCESSORIES

- A. Aluminum Trim: Fabricate frames and trim of at least 0.062-inch thick, extruded aluminum alloy with satin clear anodized finish, of proper size and shape to suit the installation. Joints are to be kept to a minimum. Corners are to be mitered to a neat, hairline closure.
- B. Markertray/Chalktray: Provide Manufacturer's standard continuous, solid type aluminum tray with ribbed section, slanted front and cast aluminum end closures.
- C. Map Rail: Provide map rail at top of each unit, complete with the following accessories.
- D. Display Rail: Provide continuous cork display rail, 1-inch OR 2-inch wide, integral with map rail, subject to customer specification.
- E. End Stops: Provide 1 end stop at each end of map rail.
- F. Map Hooks: Provide 2 map hooks with flexible metal clips for every 48 inches of map rail, or fraction thereof, subject to customer specification.

2.04 FABRICATION

- A. Porcelain Enamel Markerboards and Chalkboards: Laminate face sheet and backing sheet to core material under pressure with each substrate having a minimum of 80% coverage with 1.5-2.0 dry mils of laminating adhesive.
- B. Assembly: Provide factory-assembled markerboard and tackboard units.

2.05 FINISHES

- A. Tackboard Colors: Provide colors as selected by Architect from manufacturer's standard tack board color selections (equal to Newline Designer Fabrics - Guilford of Maine).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Prior to starting installation, verify that interior moisture and temperature approximate normal occupied conditions.
- B. Verify that wall surfaces are properly prepared and free of dirt, scaling paint, and projections or depressions that would affect the smooth, finished surfaces of markerboards.
- C. Do not proceed with installation until all unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Deliver factory built units completely assembled and of dimensions shown in Manufacturer's shop drawings as approved by Architect. Provide all mounting materials and accessories necessary for complete installation.
- B. Follow Manufacturer's instructions for storage and handling of units.
- C. Install boards level and plumb, keeping perimeter trim straight in accordance with Manufacturer's instructions.
- D. Verify all accessories have been properly installed and are operating properly.

3.03 CLEANING

- A. Clean surfaces and trim in accordance with Manufacturer's recommendations, leaving all boards ready for use.

END OF SECTION

SECTION 10.162 SOLID PLASTIC TOILET PARTITIONS

PART 1 GENERAL

1.01 SUMMARY

A. This work includes toilet partitions, urinal screens and related items necessary to complete project as indicated on the Drawings.

1.02 SYSTEM DESCRIPTION

A. Compartment Configurations

1. Toilet partitions: Floor mounted, overhead braced.
2. Urinal screens: Wall mounted, continuous flange bracket.
3. All manufacturer system appurtenances required to necessitate a complete installation.

1.03 SUBMITTALS

A. Submittals for Review

1. Shop Drawings: Include dimensioned layout, elevations, trim, closures, and accessories.
2. Product Data: Manufacturer's descriptive data for panels, hardware, and accessories.
3. Samples: 2 x 3 inch samples showing available colors in the manufacturers full line of colors.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 years experience in manufacture of solid plastic toilet compartments with products in satisfactory use under similar service conditions.

B. Installer Qualifications: Minimum 5 years experience in work of this Section.

1.05 WARRANTIES

A. Provide manufacturer's 25 year warranty against breakage, corrosion, and delamination under normal conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Scranton Products (Basis of Design)
- B. Comtec Industries
- C. Santana Products Company

2.02 MATERIALS

A. Doors, Panels and Pilasters

1. Basis of Design: Eclipse Partitions Series by Scranton Products.
2. High density polyethylene (HDPE), fabricated from extruded polymer resins, forming single thickness panel.
3. Waterproof and nonabsorbent, with self-lubricating surface, resistant to marks by pens, pencils, markers, and other writing instruments.
4. 1 inch thick with edges rounded to 1/4 inch radius.
5. Fire hazard classification: Not required.
6. Color: Shale
7. Texture: Orange Peel

B. Aluminum Extrusions: ASTM B221, 6463-T5 alloy and temper.

C. Aluminum Die Castings: ASTM B85, A380 alloy.

D. Injection Molded Plastic: High density polyethylene.

E. Rubber: Abrasion resistant Styrene Butadiene Rubber, 65 to 80 Shore A durometer, black.

2.03 HARDWARE

A. Hinges

1. Inswing hinges
 - a. Hidden pivot type fabricated from heavy-duty cast aluminum.
 - b. Auto-close feature, adjustable to 15 degree open position.
 - c. Mounted to doors with stainless steel Torx head screws and through bolted to metal post with tamper proof Torx head sex bolts.
 - d. Hinge pivot point: 6 to 8 inches from edge of door; maintain sufficient clearance to water closet.
2. Outswing hinges
 - a. Fabricated from extruded aluminum.
 - b. Auto-close feature, adjustable to 15 degree open position.
 - c. Surface mounted to doors with stainless steel Torx head screws and fastened to metal posts with countersunk tamper proof screws.
3. Provide for field adjustment of plus or minus 0.125 inch laterally and plus or minus 0.125 inch vertically.

- B. Door Keeper
 - 1. 3.5 inches long, fabricated from heavy duty extruded aluminum, clear anodized finish.
 - 2. Mount in gap between dividing panel and door.
- C. Latch and Housing
 - 1. Heavy duty extruded aluminum.
 - 2. Latch housing: Clear anodized finish.
 - 3. Slide bolt and button: Black anodized finish.
- D. Coat Hook/Bumper: Combination type, chrome plated Zamak.
- E. Door Pulls and Push Plates
 - 1. Heavy duty extruded aluminum, clear anodized finish.
 - 2. Single component providing door pull capability on outswing doors.

2.04 COMPONENTS

- A. Doors and Dividing Panels
 - 1. 55 inches high, mounted 14 inches above finished floor.
 - 2. Doors: 60 degree angle on two opposite edges for enhanced privacy.
 - 3. Dividing panels: Slotted on one edge to accept wall bracket.
- B. Metal Posts: 82.75 inches high, heavy duty extruded aluminum, clear anodized finish, fastened to foot with stainless steel tamper resistant screw.
- C. Hidden Shoe (Foot): One-piece molded polyethylene invisible shoe inserted into metal post and secured to metal post with stainless steel tamper resistant screw.
- D. Headrail Cap and Corner Cap: One-piece molded polyethylene secured to metal post with stainless steel tamper resistant screw; adjustable to level headrail to finished floor.
- E. Hidden Wall Brackets: 54 inches long, heavy duty extruded aluminum, clear anodized finish, inserted into slotted panel and fastened to panels with stainless steel tamper resistant screws.
- F. Headrail: Heavy duty extruded aluminum, designer anti-grip design, clear anodized finish, fastened to headrail bracket with stainless steel tamper resistant screw and to headrail cap and corner caps with stainless steel tamper resistant screw.
- G. Headrail Brackets: Heavy duty extruded aluminum, clear anodized finish, secured to wall with stainless steel tamper resistant screws.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install shall be in strict accordance with manufacturer's instructions and approved Shop Drawings.
- B. Erect rigid, straight, plumb and level, fastened with toggle bolts and expansion bolts securely to floors and walls, in accordance with approved shop drawings.
- C. Locate bottom edge of doors and panels 14 inches above finished floor.
- D. Provide uniform, maximum 3/8 inch vertical clearance at doors.
- E. Finish surfaces shall be left cleaned and free from imperfections and hardware properly adjusted. Architect and Owner are final judge of acceptance of panel and system appearance.

3.02 ADJUSTING

- A. Adjust doors and latches to operate correctly.

END OF SECTION

SECTION 10.200 LOUVERS

PART 1 GENERAL

1.01 SUMMARY

- A. Provide materials, labor, equipment and services necessary to furnish, deliver and install architectural louvers (including structural supports, attachment brackets and other accessories) as shown on the drawings and as specified for a complete and proper installation.
 - 1. Insulated blank-off panels required at all locations where mechanical ductwork does not occur, birdscreens where ductwork occurs.
- B. Related Sections include the following:
 - 1. Division 15 Sections for connection of mechanical equipment.

1.02 QUALITY ASSURANCE

- A. Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details and installation procedures, except as otherwise indicated.
- B. Field Measurements: Verify size, location and placement of sign band units prior to fabrication, wherever possible.
- C. Shop Assembly: Coordinate field measurements and shop drawings with fabrication and shop assembly to minimize field adjustments, mechanical attachment and field assembly of units. Pre-assemble units in ship to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, technical data, and installation instructions for required products, including finishes.
- B. Shop Drawings: Submit shop drawings for fabrication and erection of sign band units and accessories. Include plans, elevations and details of sections and connections to adjoining work. Indicate materials, finishes, fasteners, joinery and other information to determine compliance with specified requirements.

1.04 WARRANTY

- A. Provide manufacturer's standard warranty for materials and minimum 20 year for finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Greenheck Corp.
- B. Construction Specialties, Inc.
- C. Air Performance, Inc.
- D. All-Lite Louvers
- E. Architectural Louvers
- F. Ruskin Company

2.02 MANUFACTURED UNITS

- A. Provide "EHH-601", 6 inch Deep Storm Resistant Fixed Horizontal Louver as manufactured by Greenheck Corp. Design shall incorporate a drainable head member and horizontal rain resistant blades designed to collect and drain water to exterior at sill by means of multiple gutters in blades and channels in jambs and mullions.
 - 1. Frame: Heavy gauge extruded 6063-T5 aluminum, 6 in. x 0.081 in. nominal wall thickness.
 - 2. Blades: Horizontal rain resistant style, heavy gauge extruded 6063-T5 aluminum, 0.081 in. nominal wall thickness, positioned on approximately 2 in. blade spacing
 - 3. Construction: Mechanically fastened
 - 4. Sill Pan: 0.063 formed aluminum, minimum 4 inch high by full depth with welded side panels.
 - 5. Louvers and sill flashings to be installed in accordance with the manufacturer's recommended procedures to ensure complete water integrity performance of the louver system.
 - 6. AMCA Performance: A 4' x 4' unit shall conform to the following and be licensed to bear the AMCA seal:
 - a. Free Area: 7.58 sq. ft.
 - b. Free area velocity at the point of beginning water penetration: 1,391 FPM

2.03 ACCESSORIES

- A. Birdscreen: 3/4 in. x 0.051 in. flattened expanded aluminum in removable frame, inside mount (rear).

1. Provide at all locations where ductwork taps occur. Refer to mechanical drawings for additional information.
- B. Provide blank-off panels fabricated by the louver manufacturer in same finish as louver.
 1. Furnish in all areas where ductwork is not connected to louvers (taps).
 2. Blank-off panels to be 2" thick and to be faced on both sides with minimum 0.032" thick aluminum sheet. Panels to be fabricated with an expanded polystyrene (EPS) core having an R-value of 8. Panel perimeter frame to be minimum 0.050" thick-formed aluminum channels. Panel frame to be mitered at the corners.
- C. Clip Angles: Structural grade aluminum.
- D. Fastenings: Fasteners shall be aluminum or stainless steel. Provide types, gages and lengths to suit unit installation conditions.
- E. Anchors and Inserts: Use non-ferrous metal or hot-dip galvanized anchors and inserts for installation and elsewhere as required for corrosion resistance. Use stainless steel or lead expansion bolt devices for drilled-in place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.04 FABRICATION

- A. Provide equipment screen and accessories of design, materials, sizes, depth, arrangement, and metal thickness as indicated or as required for optimum performance with respect to strength; durability; and uniform appearance.
- B. Include supports, anchorage, and accessories required for complete assembly.

2.05 FINISHES

- A. General: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory after products are assembled. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces which will be visible after completing finishing process.
- B. Fluorocarbon Coating: 2-coat 70% Kynar 500 finish (AAMA 2605), minimum dry film thickness of 1.2 mil.
 1. Finish shall be applied in the plant of the manufacturer.

2. Provide custom color to be selected by the architect.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Locate and place screen units plumb, level and in proper alignment with adjacent work.
- B. Use concealed anchorages wherever possible.
- C. Form tight joints with exposed connections accurately fitted together.
- D. Use isolation tape where aluminum comes in contact with steel or concrete.

END OF SECTION

SECTION 10.400 IDENTIFYING DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following identifying devices:

1. Room identification
2. Directional signage
3. Evacuation maps
4. Overhead signage
5. Building plaque
6. Maximum Occupancy Signs
7. Aluminum Letters

1.02 SUBMITTALS

- A. Submit product data for all signs.
- B. Submit schedule of all signs and shop drawings listing sign size, letterform, and letter heights. Include construction details, layouts, size, and mounting methods.
- C. Provide a layout plan showing location of each type of sign.
- D. Provide one sample of EACH sign types for verification of materials, color, pattern, overall quality, and for adherence to drawings and requirements indicated.
- E. Provide patterns as needed for installation.

1.03 QUALITY ASSURANCE

- A. All identifying devices shall comply with requirements of 36 CFR 1191 "Americans with Disabilities Act Accessory Guidelines for Buildings and Facilities".
- B. Manufacturer specializing in manufacturing the products specified in this section with minimum five years experience. Obtain signs from one source and a single manufacturer.

1.04 DELIVERY, STORAGE, AND PROTECTION

- A. Package to prevent damage or deterioration during shipment, handling, storage and installation.
- B. Products should remain in original packaging until removal is necessary. Store products in a dry, indoor location.

1.05 WARRANTY

- A. Provide manufacturer's warranty against defects in materials or workmanship for minimum 5 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Takeform Architectural Graphics - Fusion, Quad Collection (Basis of Design)
- B. GSI-Graphic Specialties, Inc.
- C. ASI Sign Systems, Inc.

2.02 SIGN STANDARDS

- A. It is the intent of these specifications to establish a sign standard for the Owner including but not limited to primary directories, flag mounted directionals, primary room identification, restrooms, conference room, and all code compliant signage.
- B. Typography
 - 1. Type style: Helvetica Bold (HB102). Copy shall be a true, clean, accurate reproduction of typeface specified. Upper and lower case shall be used. Letter spacing to be normal and interline spacing shall be set by manufacturer.
 - 2. Arrows, symbols and logo art: To be provided in style, sizes, colors and spacing per manufacturer's standard.
 - 3. Grade II Braille utilizing perfectly round, clear insertion beads.

2.03 SIGNS

- A. Architectural Signage System
 - 1. The signage shall incorporate a decorative laminate face with applied graphics including all tactile requirements in adherence to ADA specifications.
 - 2. All signs, including work station and room ID's, overheads and flag mounts, directionals and directories shall have a matching appearance and constructed utilizing the same manufacturing process to assure a consistent look throughout.
- B. Materials
 - 1. Sign face shall be 0.035" (nominal) standard grade, high pressure surface laminate. A painted sign face shall not be acceptable.
 - 2. The substrate shall be Green 209, a natural fiber wood product with SFI certification. The sign

shall incorporate balanced construction with the core sandwiched between laminates to prevent warping. An acrylic substrate shall not be acceptable. Laminate on the sign face only shall not be acceptable.

3. Tactile lettering shall be precision machined, raised 1/32", matte PETG and subsurface colored for scratch resistance.
4. Signs shall incorporate a metal accent bar. Bars shall be anodized with a brushed satin finish. Painted bars shall not be acceptable.
5. Sign and backer edge shall be treated with a hot wax seal for moisture integrity.

C. Construction

1. The signage shall be capable of accepting paper or acetate inserts to allow changing and updating as required. Insert components shall have a 0.080" thickness non-glare acrylic window and shall be inlaid flush to sign face for a smooth, seamless appearance.
2. The signage shall, with the exception of directories and directionals, be a uniform 8½" width to facilitate inserts printed on standard width paper.
3. The signage contractor shall provide and install all signage inserts.
4. Manufacturer shall provide a template containing layout, font, color, artwork and trim lines to allow Owner to produce inserts on laser or ink jet printer. The template shall be in an Microsoft Word format.
5. The laminates (front and back) shall be pressure laminated and precision machined together to a 90-degree angle. Edges shall be smooth, void of chips, burrs, sharp edges and marks.
6. The signage shall utilize an acrylic sphere for Grade II Braille inserted directly into a scratch resistant, high pressure laminate sign face. Braille dots are to be pressure fit in high tolerance drilled holes.
7. Braille dots shall be half hemispherical domed and protruding a minimum 0.025".
8. The signage shall utilize a water based adhesive. The adhesive shall be nonhazardous and shall allow for flexing and deflection of the adhered components due to changes in temperature and moisture without bond failure.

9. All signs shall be provided with appropriate mounting hardware. Hardware shall be finished and architectural in appearance and suitable for the mounting surface.

2.04 MANUFACTURED UNITS

- A. General: Provide "Fusion - Arch 29" for all sign types as manufactured by Takeform Architectural Graphics (Basis of Design)
- B. Room identification:
 1. Standard Room ID
 - a. Takeform #F29B-BH
 - b. Size: 3.88" x 8.5"
 - c. Quantity: provide 1 at each support space (including janitor, storage, mechanical, electrical).
 2. Room I.D. w/Small Insert
 - a. Takeform #F29B-D1
 - b. Size: 8.5" x 7.0"
 - c. Insert Size: 8.5" x 2.1875"
 - d. Quantity: provide 1 at each classroom or office.
 3. Stair Identification
 - a. Takeform #F29B-BB-K2
 - b. Size: 12.11" x 8.5"
 - c. Quantity: provide 1 at each stairwell door in corridor
 4. Interior stairwell signage
 - a. Takeform #LD31405
 - b. Size: 15" x 14"
 - c. Quantity: provide 1 at each interior stairwell door (in stairwell)
 5. Restrooms
 - a. Unisex: Takeform #F29B-BB-K2
 - b. Men's: Takeform #F29B-BB-K2
 - c. Women's: Takeform #F29B-BB-K2
 - d. Size: 12.11" x 8.5"
 - e. Quantity: provide 1 in format required at each restroom
 6. Miscellaneous Room ID
 - a. Takeform #F29B-F2
 - b. Size: 9.06" x 8.5"
 - c. Quantity: provide 1 at all other openings not indicated above to receive a different type.
- C. Directional signage
 1. Takeform #F29C-W1
 2. Size: 22.31" x 11"

IDENTIFYING DEVICES

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3. Insert Size: 11" x 17"
4. Quantity: provide 6 in locations to be determined by Architect.

D. Evacuation maps

1. Takeform #F29B-R1
2. Size: 18.81" x 14"
3. Insert Size: 8.5" x 14"
4. Quantity: provide 6 in locations to be determined by Architect.

E. Overhead signage - flag mount

1. Takeform #F29-BA-F
2. Size: 6.63" x 14.25"
3. Quantity: provide 6 in locations to be determined by Architect.

F. Maximum Occupancy Signage - Provide 6 in locations to be determined

2.05 FINISHES

- A. Face/background color shall be standard grade, high pressure laminate, all colors and finishes.
 1. Color to be selected from manufacturer's full line.
- B. Standard tactile colors shall match manufacturer's ADA standard color selection.
- C. Finishes are to meet current Federal ADA and any State requirements.

2.06 BUILDING PLAQUE

- A. Cast bronze, satin finish. Size 24" x 36". Provide lettering as directed within capacity of plaque size specified. Satin polished raised letters (Optima style), letherette background, double line border. Clear lacquer finish. Concealed stud mounting.
- B. Quantity: Provide in location where directed by Architect.

2.07 ALUMINUM LETTERS

- A. Equal to Custom Cast Aluminum Letter is manufactured by Gemini Incorporated
 1. Style: Goudy Extra Bold, dark bronze anodized.
 2. Size: 14" tall upper case (1-1/4" depth).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Installer shall examine signs for defects, damage and compliance with specifications. Installation shall

not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. General: Installation locations shall be in accordance with ADA specifications. Locate signs where indicated by Architect on approved layout plan using mounting methods in compliance with manufacturer's written instructions.

1. The signage contractor will coordinate installation schedules with the Owner and Architect.
2. Installation shall be performed by manufacturer's personnel trained and certified in manufacturer's methods and procedures.
3. Installer to submit CAD generated location plan noting the location of all signage and cross referenced to message schedule for architect's approval.
4. Installer to conduct a pre-installation survey prior to manufacturing to verify message schedule copy and sign location. Each location shall be noted using low tack vinyl. Full scale renderings of directories and directionals shall also be provided. Any location discrepancy or message issues shall be submitted to architect for review.
5. Signs shall be level, plumb, and at heights indicated with sign surfaces free from defects.
6. Upon completion of the work, signage contractor shall remove unused or discarded materials, containers and debris from site.

B. Building plaque / letters

1. Mount level where indicated or directed, secured with concealed threaded rods mounted on back of tablet inserted into cement filled holes in brickwork.

3.03 FIELD QUALITY CONTROL

A. A minimum of 2 site visits shall be required by the sign contractor.

1. Prior to submission of schedule for site assessment and evaluation.
2. Final walk-through and punchlist.

3.04 CLEANING

- A. Upon completion all identifying devices shall be undamaged, level, plumb, true to line and securely anchored.
- B. Clean all exposed surfaces and protect to prevent damage during remainder of construction period.

END OF SECTION

SECTION 10.520 FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

- A. Provide fully charged portable fire extinguisher where noted. The types of fire extinguishers are as follows:
1. Semi-Recessed Cabinet mounted (FEC)
 2. Bracket Mounted (FE)

1.02 REFERENCES

- A. NFPA1 0-Portable Fire Extinguishers
B. UBC 43-6 (ASTM E814-83) - Fire rated cabinets fabricated in accordance to measure, restore, perform.
C. Americans with Disabilities Act 1990-Maximum 4 cabinet projection for corridors.

1.03 SUBMITTALS

- A. Product Data: For extinguishers and cabinets. Include installation instructions for cabinets and brackets.

1.04 QUALITY ASSURANCE

- A. Conform to NFPA 10 requirements for portable fire extinguishers.
B. Provide fire extinguishers, cabinets, and accessories by single manufacturer.
C. Conform to UBC 43-6 (ASTM E814-83) for fire resistive wall performance where necessary.
D. Conform to Americans with Disabilities Act 1990 on maximum cabinet projection of C in corridors where necessary.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. J.L. Industries (Activar, Inc.)
B. Larsens Manufacturing Company
C. Potter Roemer

2.02 MATERIALS

- A. Provide cabinets with fire-rated option (J.L. Industries FX Fire Rated), if applicable. Rating of the cabinet shall match the rating of the wall in which the cabinet is being installed.

- B. Type 1 Fire Extinguisher Cabinets (FEC):
 - 1. Provide at all locations where cabinets are called for.
 - 2. Style shall be aluminum, recessed sized for the applicable fire extinguisher as specified herein.
 - a. Equal to J.L. Industries "Embassy Series, Model #5634W10".
 - (1) Door Style: Vertical Duo with Saf-T-Lok and pull
 - (2) Door Glazing: Clear 1/4 inch Acrylic
 - b. Door & Trim Construction: 7/8" thick formed cabinet doors in #4 satin stainless steel. Doors feature two concealed hinges at top & bottom of door.
 - c. Trim Style & Depth: trimless, 6 inch recessed cabinet.
 - d. Tub: The tub is constructed of cold rolled steel with white powder-coat finish standard. Tub forms a 1" flange to cover cut edges of wallboard material.
- C. Fire Extinguisher Brackets (FE): Provide Extinguisher Brackets for the applicable fire extinguisher as indicated below in locations as indicated on the Drawings.
- D. Fire Extinguishers:
 - 1. Dry Chemical Type (Type 1): J.L. Industries "Model Cosmic 10E"

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
- B. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
- C. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.
- D. Provide and verify servicing, charging and tagging of all fire extinguishers.

END OF SECTION

FIRE PROTECTION SPECIALTIES

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SECTION 10.700 EXTERIOR SUN CONTROL DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes: Aluminum Sunshade Systems, including accessories, mountings, and shims. Sunshades are anchored directly to the vertical and/or horizontal mullions.

1. Types of Sunshades include:

a. Basis of Design: Versoleil™ Horizontal Single Blade SunShade compatible with:

1) 1600 Wall System™1 Curtain Wall

B. Related Sections

1. 08.410 Aluminum Entrances, Curtainwall and Storefronts

2. 08.800 Glazing

1.03 DEFINITIONS

A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) - AAMA Glossary (AAMA AG).

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance

1. Combined load on sunshade configurations to be determined in accordance with ASCE 7 or applicable code requirements. Combined load consists of wind, snow and ice loads

2. Design sunshade configurations to withstand stresses due to combined load. Stresses resulting from thermal expansion/contraction, shall not cause permanent deformation of sunshade assemblies or disengagement from the glazed system.

3. Test horizontal and vertical sunshade configurations to meet a minimum load of 65 psf with a factor of safety of 2 times the design load for the horizontal blade and a factor of safety

of 1.5 times the design load for the vertical blade.

4. The assembled sunshade shall be capable of supporting a uniformly distributed load of psf without damage, permanent deformation, or disengagement from the glazed system mullion.
 5. Blade deflection shall not exceed L/120 of span length.
 6. Submit test reports verifying compliance with each test requirement required by the project.
- B. Shading Performance
1. Design shall allow for one time adjustment of the aerofoil blade angle and size to optimize the shading performance based on project location, latitude, altitude, building orientation, surrounding conditions, and aesthetic requirements.
 - a. Blades shall be capable of orientations of:
 - 1) Horizontal sunshade configurations: Clockwise is positive and anti-clockwise negative 0°, -5°, -10°, -15°, -20°, -25°, -30°, and -35°.
 - b. Following blade sizes: 12" (305).
- C. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For aluminum exterior sunshades. Include plans, elevations, sections, blade angles, blade spacing and attachments to compatible systems.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who has had successful experience with installation of the same or similar systems required for the project and other projects of similar size and scope.

- B. Manufacturer Qualifications: A manufacturer capable of fabricating exterior sunshades, and glazed aluminum curtain wall and storefront systems, that meet or exceed performance requirements.
- C. Source Limitations: Obtain aluminum exterior sunshades and glazed aluminum curtain walls and storefront systems through one source from a single manufacturer.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockups for type(s) of sunshade elevation(s) indicated, in location(s) shown on Drawings.

1.07 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for sunshades by field measurements before fabrication and indicate measurements on Shop Drawings.

1.08 WARRANTY

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
 - 1. Warranty Period: Two (2) years from Date of Substantial Completion of the project.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product:
 - 1. Versoleil™ Single Blade Horizontal Sunshade, Versoleil™ Single Blade Vertical Sunshade by Kawneer Company Inc.

2. EFCO-E-Shade.
3. Oldcastle - Solar Eclipse.

2.02 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by glazed aluminum curtain wall and storefront system manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8 mm) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6, 6105-T5, or 6061-T6 alloy and temper.
- B. Thermal Barrier: When applied on a thermally broken compatible system, sunshade shall be thermally isolated from the interior aluminum mullions by a nominal 0.25" (6.3 mm) thick low conductance material.
- C. Aluminum sheet alloy: Shall meet the requirements of ASTM B209.
- D. Sealant: For sealants required within fabricated sunshade system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.
- E. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of glazed curtain wall and storefront members are nominal and in compliance with AA Aluminum Standards and Data.

2.03 SUNSHADES

- A. Sunshade Members: Manufacturer's standard extruded or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
- B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposed shall be stainless steel.
- C. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- D. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- E. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle sunshade materials and components to avoid damage.

Protect sunshade materials against damage from elements, construction activities, and other hazards before, during and after installation.

2.04 ACCESSORY MATERIALS

A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.05 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Sunshade: Fabricate components for assembly following approved shop drawings and/or manufacturer's standard installation instructions.

D. After fabrication, clearly mark components to identify their locations in Project according to approved shop drawings.

2.06 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing: Match Curtainwall Finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General

1. Comply with manufacturer's written instructions. Refer to installation instructions of the compatible curtain wall or storefront system.
2. Please note that the installation instructions can differ from one compatible system to another one.
3. Do not install damaged components.
4. Fit joints to produce hairline joints free of burrs and distortion.
5. Rigidly secure non-movement joints.
6. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
7. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
8. Seal joints watertight where shown on approved shop drawings and/or manufacturer's standard installation instructions.

B. Metal Protection

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components plumb and true in alignment with established lines and grades.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

E. Install glazing as specified in Division 08 Section "Glazing."

3.03 ADJUSTING, CLEANING AND PROTECTION

A. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum sunshade system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

B. Cleaning: 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. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 10.801 TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

- A. Provide toilet and other accessory items in locations as indicated on the Drawings and as specified in the schedule herein.
 - 1. Refer to Toilet Accessory Schedule on Drawings for complete schedule.
 - 2. Contractor to coordinate installation and provide blocking in wall for all items specified.
- B. Related Sections include the following:
 - 1. Division 10 Section "Toilet Compartments" for robe hooks on compartment doors.

1.02 SUBMITTALS

- A. Product Data
 - 1. For each accessory item specified, including details of construction relative to material, dimensions, gauges, profiles, method of mounting, specified options, and finishes.
- B. Setting Drawings
 - 1. Where cutouts are required in other work, provide templates, substrate preparation instructions, and directions for preparing cutouts and for installation of anchorage devices.

1.03 QUALITY ASSURANCE

- A. Inserts and anchorages: Furnish inserts and anchoring devices that must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.
- B. Accessory Locations: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units.
- C. Single-Source Responsibility: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Architect.
- D. Comply with 36 CFR 1191 "Americans with Disabilities Act Accessory Guidelines for Buildings and Facilities" including requirement regarding location and installed structural strength of grab bars.

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PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Bobrick Washroom Equipment
- B. American Specialties Inc (ASI)
- C. Bradley Corporation

2.02 MATERIALS

- A. Stainless Steel: AISI Type 304, with polished No. 4 finish, 22 gauge minimum thickness, unless otherwise indicated.
- B. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16: castings, ASTM B-30
- C. Sheet steel: Cold-rolled, commercial quality ASTM A366, 20-gauge minimum, unless otherwise indicated. Surface preparation and metal pretreatment as required for applied finish.
- D. Galvanized Steel Sheet: ASTM A527, G60.
- E. Galvanized Steel Mounting Devices: ASTM A153, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same materials as accessory unit or of galvanized steel where concealed.
- G. Keys: Unless otherwise indicated, provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of 6-keys to Owner and obtain receipt.

2.03 GRAB BARS (A)

- A. Provide Stainless steel grab bar, 1-1/2" outside diameter, heavy-duty grab bars as follows:
 - 1. Mounting: Concealed, manufacturer's standard flanges and anchorages, with concealed mounting plate and snap flange cover to conceal mounting screws.
 - 2. Clearance: 1-1/2 inches clearance between wall surface and inside face of bar.
 - 3. Gripping Surfaces: Manufacturer's standard nonslip texture.
 - 4. Locations and configurations as shown on Drawings.
 - 5. Manufacturer / Model No.:
 - a. 36" x 54" Grab Bar: equal to Bobrick, No. B-68137

- b. 24" x 36" Grab Bar: equal to Bobrick, No. B-68616 (Provide at ADA shower)

2.04 MIRROR UNITS (B)

- A. Stainless Steel Framed Mirror Units: Fabricate frame with angle shapes of not less than 18 gauge with square welded corners mitered and ground smooth. Provide with No. 4 satin polished finish. 1/4 inch tempered glass.
- B. Mountings: Concealed type, manufacturer's standard.
- C. Manufacturer / Model No.:
 - 1. 24 inch wide x 42 inch high:
 - a. Bobrick No. B-290 2442 (custom size)
 - b. Bradley Model 780-2442 (custom size)

2.05 SANITARY NAPKIN DISPOSAL (C)

- A. Fabricate of stainless steel with all-welded construction; exposed surfaces shall have satin finish. Cover shall be one piece seamless construction secured to container with a full-length stainless steel piano-hinge.
- B. Mountings: Concealed type, manufacturer's standard.
- C. Location: provide 1 at each women's gang water closets and all single hole toilet locations.
- D. Manufacturer / Model No.:
 - 1. Bobrick No. B-270
 - 2. ASI No. 20852
 - 3. Bradley Model 4A10

2.06 TOILET PAPER DISPENSER (D)

- A. Double-roll toilet tissue dispenser shall be type-304 stainless steel with satin finish. Unit shall accommodate two standard-core toilet paper rolls up to 5-1/2" diameter (1800 sheets). Flanges and support arms shall be 22 gauge and equipped with concealed, 18 gauge mounting brackets that are secured to concealed, 19-gauge wall plates with stainless steel setscrews. Spindles shall be equipped with heavy-duty internal springs.
- B. Mounting Height: 20" to top of unit
- C. Manufacturer / Model No.:
 - 1. Multi Roll Toilet Tissue Dispenser: Bobrick No. B-76867

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- 2.07 GARMENT (COAT) HOOKS (E)
- A. Surface-mounted hook shall be 11-gauge, type-304 stainless steel with satin finish and all-welded construction. Unit projects 7/8" from wall.
 - B. Mountings: manufacturer's standard.
 - C. Manufacturer / Model No.:
 - 1. Equal to Bobrick No. B-233
- 2.08 WALL MOUNTED SOAP DISPENSER (F)
- A. Surface-mounted soap dispenser shall be type-304 stainless steel with satin-finish. Corrosion-resistant valve shall dispense commercially marketed all-purpose hand soaps. Valve shall be operable with one hand and with less than 5 pounds of force to comply with barrier-free accessibility guidelines. Container body and back plate shall be epoxy-sealed to prevent warping and leakage.
 - B. Soap dispenser shall have concealed, vandal-resistant mounting. Locked, hinged stainless steel lid for top filling shall require special key to open. Capacity shall be 40-fl oz (1.2-L).
 - C. Manufacturer / Model No.:
 - 1. equal to Bobrick No. B-4112
 - 2. All units to be fully stocked with soap at Substantial Completion.
- 2.09 PAPER TOWEL DISPENSER AND WASTE RECEPTACLE (G)
- A. Recessed paper towel dispenser and waste receptacle shall be type-304 stainless steel with all-welded construction; exposed surfaces shall have satin-finish. Flange shall be drawn, one-piece, seamless construction. Paper towel dispenser door shall be drawn, 18-gauge, one-piece, seamless construction; secured to cabinet with a full-length stainless steel piano-hinge; and equipped with a stainless steel cable door swing limiter and flush tumbler lock keyed like other accessories. Install in Mens 132 and Womens 135 only.
 - B. Surface mounted paper towel dispenser and waste receptacle shall be type-304 stainless steel with all-welded construction; exposed surfaces shall have satin-finish. Flange shall be drawn, one-piece, seamless construction. Paper towel dispenser door shall be drawn, 18-gauge, one-piece, seamless construction; secured to cabinet with a full-length

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stainless steel piano-hinge; and equipped with a stainless steel cable door swing limiter and flush tumbler lock keyed like other accessories.

- C. Paper towel dispenser shall dispense 600 C-fold or 800 multifold paper towels. Unit equipped with TowelMate consisting of a 90° return towel guide angle inside cabinet to prevent paper towels from falling forward out when door is opened for servicing and a Nylon Rod across the center of the towel tray to dispense paper towels one at a time.
- D. Waste receptacle shall have a formed, 18-gauge, one-piece, seamless, removable front panel with top edge hemmed. Unit equipped with LinerMate trash liner holder fabricated with molded plastic trash liner holder sleeve and a 20-gauge stainless steel, U-shaped support strap; riveted construction. Trash liner holder shall have an arc at front and same shape as inside of waste receptacle area. LinerMate facilitates installation and removal of disposable trash liners and retains liner inside waste receptacle. Capacity of waste receptacle shall be 15.0-gal.
- E. Mountings: Concealed type, manufacturer's standard.
- F. Manufacturer / Model No.:
 - 1. Equal to Bobrick No. B-4394 (with TowelMate and LinerMate)
 - 2. All units to be fully stocked at Substantial Completion. This includes paper towels and bags in waste receptacle.

2.10 PAPER TOWEL DISPENSER (H)

- A. Fabricate of stainless steel with all-welded construction; exposed surfaces shall have satin finish. Paper towel dispenser shall be one piece seamless construction secured to cabinet with a full-length stainless steel piano hinge, and equipped with a flush tumbler lock. Rounded towel tray shall have a hemmed opening to dispense paper towels without tearing. Dispenser shall be sized to dispense not less than 600 C-fold or 800-multi fold paper towels without use of special adapters.
- B. Mountings: Concealed type, manufacturer's standard.
- C. Manufacturer / Model No.:
 - 1. Bobrick No. 4262 (with TowelMate)

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2. All units to be fully stocked with paper towels at Substantial Completion.

2.11 SEAT COVER DISPENSER (J)

A. Surface-mounted toilet seat cover dispenser shall be constructed of 20-gauge, type-304 stainless steel with satin finish. Seat cover dispenser front shall be drawn, one-piece, seamless construction. Unit shall have rectangular opening.

B. Mountings: Concealed type, manufacturer's standard.

C. Mounting Height: 45" - 49"

D. Manufacturer / Model No.:

1. Bobrick No. B-4221

2. Provide 1 at each water closet location.

2.12 SURFACE MOUNTED BABY CHANGING STATION (K)

A. Horizontal Unit: 18 gauge, type 304 satin stainless steel exterior finish with high density polyethylene with Microban antimicrobial interior.

B. Design of unit shall be surface mounted. Unit shall be equipped with a pneumatic cylinder for controlled opening and closing of bed. Bed shall be secured to back plate with a concealed, full-length steel-on-steel hinge.

C. Accessories shall include the following:

1. Integral, built-in Liner Dispenser for 13" x 19" liners.

2. Replaceable snap-lock protective holding straps.

D. Mountings: manufacturer's standard.

E. Location: provide 2 in locations as directed by Architect.

F. Manufacturer / Model No.:

1. Koala Kare Products (Bobrick) No. KB110-SSWM.

2. Provide 1 each in Mens 114 and Womens 115.

2.13 MOP HOLDER WITH SHELF (L)

A. Utility shelf with mop/broom holders and rag hooks shall be type-304 stainless steel with all-welded construction; exposed surfaces shall have satin finish. Shelf shall be 18 gauge, 8" deep with 3/4 inch return edges. Unit shall have 4 16-gauge hooks and 3 spring-loaded rubber cam holders.

B. Mounting Height: as directed by Architect

C. Location: provide 1 at each mop sink location.

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D. Manufacturer / Model No.:

1. Bobrick No. B-239x34
2. ASI No. 1308-3
3. Bradley Model 9933

2.14 STAINLESS STEEL SPLASH (M)

A. Fabricate panels from Type 304, minimum 22 gauge stainless steel.

1. 30 inch wide x 30 inch high - provide on both sides of corner mop sink.

PART 3 EXECUTION

3.01 EXAMINATION

A. Installer must examine substrates, previously placed inserts and anchorages necessary for mounting of toilet accessories and other conditions under which installation is to occur, and must notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.02 INSTALLATION

A. Install toilet accessory units in accordance with manufacturer's instructions, using fasteners which are appropriate to substrate and recommended by manufacturer of unit. Install units plumb and level, firmly anchored in locations indicated.

3.03 ADJUSTING

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly.

3.04 CLEANING

A. Clean and polish all exposed surfaces after removing protective coatings.

END OF SECTION

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SECTION 11.130 FIXED PROJECTION SCREEN

PART 1 GENERAL

1.01 SUMMARY

- A. Fixed projection screen as shown on Drawings.
- B. Related Sections include the following:
 - 1. All Division 16 Sections

1.02 SUBMITTALS

- A. Product data for projection screens and accessories.
- B. Shop drawings showing dimensions, method of attachment, structural support, bracing, and electrical wiring.
- C. Samples
 - 1. Viewing surface: 6 by 6 inches minimum size.
- D. Manufacturer's installation, maintenance, and cleaning instructions.

1.03 QUALITY ASSURANCE

- A. Source limitation: Obtain projection screens from single manufacturer as a complete unit including necessary mounting hardware, and accessories.
- B. Motorized projection screens shall be certified for use in the United States by Underwriters Laboratory (UL), Inc. and shall bear UL label.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver projection screens until building is enclosed, other construction within spaces where screens will be installed is substantially complete, and installation of screens is ready to begin.
- B. Deliver products in manufacturer's original, unopened, undamaged containers with labels intact.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Draper
- B. Da-Lite Screen Co.
- C. BEI Audio-Visual Products

2.02 COMPONENTS

- A. Type: Extruded aluminum frame with finish and viewing surface 8" truss frame shall be modular.
 - 1. "Stage Screen" as manufactured by Draper, Inc.

- B. Size Viewing Area: 12'x6" x 20'x0"; Overall Area: 166.5" x 256.5".
- C. Attach viewing surface to frame using bungee cord loops with nylon pull-tabs. The viewing surface shall be framed by black borders on all four sides.

2.03 VIEWING SURFACE

- A. Grey projection surface, HiDef Grey, equal to Draper Grey XH600V
- B. Joints: Viewing surface shall contain no seams.

3.01 PREPARATION

- A. Coordinate layout and installation of projection screen with wall construction and related components penetrating or above ceilings such as lighting fixtures, mechanical equipment, ductwork, and fire-suppression system.
- B. Coordinate requirements for blocking, structural supports, and bracing to ensure adequate means for installation of screens.

3.02 INSTALLATION

- A. Install projection screens and controls at locations and heights indicated on Drawings.
- B. Comply with screen manufacturer's written instructions and shop drawings.
- C. Install screens securely to supporting substrate so that screens are level and back of case is plumb. Provide all required fasteners and accessories for a complete installation.

3.03 ADJUSTING

- A. Ensure that screen is level and viewing surface plumb when extended. Correct deficiencies.

3.04 CLEANING

- A. Clean screen and exposed parts upon completion of installation.

3.05 DEMONSTRATION

- A. Demonstrate operation of screen to Owner's designated representatives.

3.06 PROTECTION

- A. Protect projection screens after installation from damage from construction operations. If damage occurs, remove and replace damaged components or

entire unit if directed to provide units in their original, undamaged condition, at no cost to the Owner.

END OF SECTION

SECTION 12.480 RUGS AND MATS

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes the following types of entrance flooring systems:
 - 1. Floor Grids & Frame Assemblies
- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete" for recess.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM)
- B. The Aluminum Association
- C. The National Floor Safety Institute (NFSI)

1.03 SUBMITTALS

- A. Product Data:
 - 1. Include Data for each type of floor mat/grid and frame specified, including manufacturer's specifications and installation instructions.
- B. Shop Drawings:
 - 1. Include drawings of sufficient detail showing layout of mat/grid and frame specified including details indicating construction relative to materials, direction of traffic, spline locations, profiles, anchors and accessories.
- C. Samples for verification purposes:
 - 1. Submit an assembled section of floor mat/grid and frame members with selected tread insert showing each type of color for exposed floor mat/grid, frame and accessories required.
- D. Maintenance data in the form of manufacturer's printed instructions for cleaning and maintaining floor mats/grids.

1.04 QUALITY ASSURANCE

- A. Flammability in accordance with ASTM E648, Class I, Critical Radiant Flux, minimum 0.45 watts/m².
- B. Slip resistance in accordance with ASTM D-2047-96, Coefficient of Friction, minimum .060 for accessible routes.
- C. Standard rolling load performance is 500 lb./wheel with larger loading requirements as specified (load

applied to a solid 5" x 2" wide polyurethane wheel, 1000 passes without damage).

D. Single Source Responsibility: Obtain floor mats/grids and frames from one source of a single manufacturer.

E. Utilize superior structural stainless steel Type 304 components.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the project site ready for use and fabricated in as large sections and assemblies as practical, in unopened original factory packaging clearly labeled to identify manufacturer.

1.06 PROJECT CONDITIONS

A. Field measurements: Check actual openings for mats/grids by accurate field measurements before fabrication. Record actual measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

B. For recess application coordinate frame installation with concrete construction to ensure recess and frame anchorage are accurate and that the base is level and flat. Defer frame installation until building enclosure is complete and related interior finish work is in progress.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Construction Specialties, Inc.

B. Arden Architectural Specialties

C. Kadee Industries, Inc.

D. Balco

E. J.L. Industries -Activar Construction Products Group

2.02 MATERIALS

A. General: Drawings and specifications are based on manufacturer's literature from Construction Specialties, Inc. unless otherwise indicated.

B. Stainless steel -Type 304 stainless steel for surface wires and support bars

2.03 FLOOR GRIDS

A. General

1. Grids shall be manufactured from type 304 stainless steel in 1-1/8" depth. Wires to be .140"

x .125" connected utilizing a U-clip support structure and spaced .187 apart.

B. All locations unless noted otherwise:

1. Provide "G6P GridLine 2" as manufactured by Construction Specialties, Inc.

2.04 FRAMES

A. General: Frames shall be Type 304 stainless steel with 1/8" exposed surface, 1-1/4" deep recess.

B. Interior locations:

1. Provide Construction Specialties, Inc. "SSA - Stainless Steel Angle Frame". Frame shall be Type 304 stainless steel with 1/8" exposed surface.

C. Lock Down Mechanism:

1. Construction Specialties, Inc. "HL -Hidden Lock Down" shall be a 1-7/8" x 1" x 1/8" hidden device to secure the grid to the concrete surface. Made from Type 304 stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Manufacturer shall offer assistance and guidance to provide a template or irregular shaped mat/grid assemblies to ensure a proper installation.

3.03 INSTALLATION

A. Install the work of this section in strict accordance with the manufacturer's recommendations.

B. Set grid at height recommended by manufacturer for most effective cleaning action.

C. Coordinate top of grid surfaces with bottom of doors that swing across to provide ample clearance between door and grid.

3.04 PROTECTION

A. After completing required frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses, and cover frames with

plywood protective flooring. Maintain protection until construction traffic has ended and project is near time of substantial completion.

1. Grouting area around frame is not acceptable.
- B. Defer installation of floor grids until time of substantial completion of project.

END OF SECTION

SECTION 12.494 MANUAL AND MOTORIZED ROLLER SHADES

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes roller shades and motorized shade operators and all accessories for a complete installation.
- B. Related Sections include the following:
 - 1. Division 16 Sections for electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches for motorized shade operation.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.
 - 1. Motorized Shade Operators: Include operating instructions.
 - 2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
 - 3. Controls: Include operating/programming instructions and mounting arrangements.
- B. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other work, control details, operational clearances, and relationship to adjoining work.
 - 1. Motorized Shade Operators: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 - 2. Wiring Diagrams: Power, system, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

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1. Ceiling suspension system members and attachment to building structure.
 2. Ceiling-mounted or penetrating items including light fixtures, air outlets and inlets, speakers, sprinklers, recessed shades, and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
 3. Shade mounting assembly and attachment.
 4. Size and location of access to shade operator, motor, wall switch, and adjustable components.
 5. Minimum Drawing Scale: 1/8 inch = 1 foot.
- D. Samples for Initial Selection: For each colored component of each type of shade indicated. Include similar Samples of accessories involving color selection.
- E. Qualification Data: For Installer.
- F. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:
1. Methods for maintaining roller shades and finishes.
 2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
 3. Operating hardware.
 4. Motorized shade operator.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Product Standard: Provide roller shades complying with WCMA A 100.1.
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in factory packages, marked with manufacturer and product name, and location of

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installation using same designations indicated on Drawings and in a window treatment schedule.

1.05 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.06 WARRANTY

- A. Provide manufacturer's standard warranty covering 2 year parts and labor and 8 years limited parts warranty to repair and replace defective equipment.

1.07 MAINTENANCE

- A. Make ordering of new equipment for expansions, replacements, and spare parts available to a qualified dealer or installer.
- B. Make replacement parts available for minimum of ten years from date of manufacture.
- C. Provide factory direct technical support hotline 24 hours per day, 7 days per week.
- D. Provide on-site service support within 24 hours anywhere in continental United States.
- E. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system commissioning.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Draper
- B. Lutron Electronics Co.

C. Nysan Shading Systems

2.02 ROLLER SHADES

- A. Provide "Manual FlexShade" and "Motorized FlexShade" as manufactured by Draper, Inc.
 - 1. NOTE: Room Type - Manual FlexShade is to be used at Office type rooms; Motorized FlexShade is to be used at Classroom type rooms.
- B. Shade Band Material: Vinyl-coated fiberglass.
 - 1. Fabric Widths: As indicated on Drawings schedule.
 - 2. Pattern/Style: European-Style Mesh Fabrics "M" Screen
 - 3. Fabric Content: PVC coated fiberglass yarn woven mesh. 11.9 oz. per sq. yd.
 - 4. Colors: As selected by Architect from manufacturer's full range.
 - 5. Material Solar-Optical Properties: 3% openness.
 - 6. Bottom Hem: Straight.
 - 7. Trim: As indicated by manufacturer's designation for style and color.
- C. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with manufacturer's standard method for attaching shade material. Provide capacity for one roller shade band(s) per roller, unless otherwise indicated on Drawings. Wherever possible provide one single roller shade per window, as indicated on Drawings. Width limitations will require more than one shade on some windows. Note the following: Motorized FlexShade maximum unit width is 16'-0". Motorized Colossal FlexShade maximum unit width is 28'-9". Units ship fully assembled. If more than one shade is required for any window wall, position the "joint" to occur at the middle of a window mullion.
- D. Mounting Brackets: Galvanized or zinc-plated steel.
- E. Bottom Bar: Steel or extruded aluminum, with plastic or metal capped ends. Provide concealed, by pocket of shade material, internal-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.

- F. Mounting: Ceiling, as indicated on Drawings, mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.
 - 1. Provide wall clips with closures at all recessed shade locations (motorized).
 - 2. Provide fascia/headbox cover. 3/4" at surface mount locations (manual).
- G. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard for anchoring roller shade bottom in place and keeping shade band material taut.
- H. Shade Operation: Motorized operator at Classroom type locations and Manual Operation at Office type rooms.
- I. Programmable Controls: Provide (1) SC1 Programmable Control for each shade. Controls to link all shades within each area or room for tandem (simultaneous) raising and/or lowering.
- J. Wall Switch: Provide (1) 6 button, 4 stop wall switch for each room.
- K. Remote Control: Remote control for each area (room) shall consist of: (1) IR transmitter and (1) IR Remote control eye.
 - 1. Provide 15 remote controls in locations as directed by Architect.
- L. Roller Shade Widths / Sizes: Coordinate all shade widths with the architect prior to commencement of work.

2.03 ROLLER SHADE FABRICATION

- A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.
- B. Concealed Components: Non-corrodible or corrosion-resistant-coated materials. Lifting Mechanism: With permanently lubricated moving parts.
- C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74°F: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

- D. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting roller, and operating hardware and for hardware position and shade mounting method indicated.
- E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal non-corrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.
- F. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
- G. Colors of Metal and Plastic Components Exposed to View: As selected by Architect from manufacturer's full range.

2.04 MOTORIZED ROLLER SHADE OPERATORS

- A. Manufacturer: Provide operator manufactured by roller shade manufacturer.
- B. General: Provide factory-assembled motorized shade operation systems designed for lifting shades of type, size, weight, construction, use, and operation frequency indicated. Provide operation systems of size and capacity and with features, characteristics, and accessories suitable for Project conditions and recommended by shade manufacturer, complete with electric motors and factory-rewired motor controls, remote-control stations, remote-control devices, power disconnect switches, enclosures protecting controls and all operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with the building electrical system.
- C. Comply with NFPA 70.
- D. Electric Motors: UL-approved or -recognized, totally enclosed, insulated motor, complying with NEMA MG 1, with thermal-overload protection, brake, permanently lubricated bearings, and limit switches; sized by shade manufacturer to start and operate size and weight of shade considering service factor or

considering Project's service conditions without exceeding nameplate ratings.

1. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 2. Motor Characteristics: Single phase, 110V, 60 Hz.
 3. Motor Mounting: Within manufacturer's standard roller enclosure.
- E. Position of Motor and Electrical Connection: For Single shade applications: Right of rollers, as determined by hand of user facing shade from inside, unless otherwise recommended by manufacturer. For two or more shades on one wall, right and left side of roller, meeting in the middle.
- F. Controls: Provide with manufacturer's Control System for control of shade, including a minimum of four stops.
- G. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop shade at fully raised and fully lowered positions.
- H. Operating Function: Stop and hold shade at open, midpoint, and closed positions.
- I. Operating Features: Include the following:
1. Switching with integrated switch control; single face plate.
 2. Capable of interface with audiovisual control system.
 3. Backup gear and crank operator for manual operation during power failures with detachable handle, length required to make operation convenient from floor level.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer

than 2 inches to interior face of glass. Allow clearances for window operation hardware.

B. Connections: Connect motorized operators to building electrical system.

3.03 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.04 CLEANING AND PROTECTION

A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

SECTION 12.497 DRAPERIES AND TRACKS

PART 1 GENERAL

- 1.01 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- 1.02 GOVERNING CLAUSE: For the sake of brevity these specifications shall omit phrases such as "Contractor shall furnish and install", "unless otherwise indicated or specified", etc., but these phrases are nevertheless implied. Mention of materials and operations requires the Contractor to furnish and install such materials and perform such operations completely to the satisfaction of the Owner.
- 1.03 SCOPE OF WORK: One company shall be responsible for the installation of all aspects of the stage equipment. Work under this section shall include the furnishing of all labor, materials, tools, transportation services, supervision, etc., necessary to complete installation of new stage equipment as well as any other items as herein listed, all as described in these specifications, as illustrated on the accompanying drawings; or as directed by the Architect or his Representative.
- 1.04 CONTRACTOR'S QUALIFICATIONS: The Contractor shall be fully experienced in the fabrication and installation of the stage equipment as herein specified. The Contractor shall have been in business for five (5) full years preceding the date of this bid doing work similar to the type specified and under the same name. The Contractor shall employ only fully trained stage riggers and mechanics for the erection of the stage equipment. The stage riggers shall be completely familiar with the type of equipment to be installed. A competent Job Superintendent shall be on the job at all times when work is in progress. He shall represent the Contractor and all directions given by him shall be as binding as if given by the Contractor.
- 1.05 SUBSTITUTIONS: Specific fabric and items of equipment are specified by trade names. It has been determined by the Owner that these are the particular items desired by

the owner and established a standard of quality, equipment function and/or process. It is not the purpose nor intent of these documents to eliminate competitive bids. In order to allow proper and fair comparison of pricing, each contractor is required to submit their base bid price on the specified equipment. A contractor may submit an alternate bid based on equipment different from that specified only if that Contractor has received prior approval in writing from the Owner at least 10 days prior to bid. Accompanying each request shall be a letter specifically detailing each substitution including catalog data, specifications, swatches, operative samples, technical information, drawings, performance and test data, and complete descriptive and functional information to assist in a fair evaluation. Failure to submit any substitution for prior approval or not providing sufficient data for evaluation shall require the exact item specified to be furnished. Owner's approval of a substitution for bid purposes will not relieve the contractor from the responsibility of meeting all specification criteria. If an approval of a substitution is granted, the Contractor shall be fully responsible for any and all changes (wiring, power, distribution, support structure, etc.) such substitution shall require.

- 1.06 DEFECTIVE OR NON-APPROVED MATERIALS: Should any stage equipment be found defective, not meeting specifications, or that which has not been approved in writing by the Owner shall, upon discovery (including any time within the period of the guarantee), be replaced with the specified equipment or material at no additional cost.
- 1.07 GUARANTEE: The Contractor shall guarantee all of the work that is performed under this contract, including all materials, and workmanship, for a period of one (1) year from the date of full acceptance of the work. Lamps for lighting fixtures shall be guaranteed against failure for thirty (30) days. Nothing in this guarantee shall cause repair or replacement by the Contractor where negligence, neglect or improper operation by the Owner has caused the failure of any equipment installed under this contract.

1.08 DISCREPANCIES: All equipment shall be sized to fit properly. The exact measurements are the responsibility of the Contractor. If there are discrepancies in the specifications, the Contractor shall ask for a clarification from the Owner. If no clarification is requested, the Owner's judgment shall rule.

1.09 PRE-APPROVED STAGE EQUIPMENT CONTRACTORS: One company shall be responsible for the installation of all aspects of the stage equipment as specified in this section. This shall include but not be limited to all rigging, curtains, tracks, motors and control, stage lighting fixtures, stage/house dimming, and dimming controls and miscellaneous equipment. The following companies have prior approval as STAGE EQUIPMENT CONTRACTORS:

A. Texas Scenic Company, Inc.

B. J.R. Clancy

In order to be considered as a Stage Equipment Contractor on this project, each Contractor requesting approval must submit to the Architect at least ten (10) days prior to the date of bid opening a letter expressing his intent to bid. This letter shall include a list of at least five (5) projects of similar size and scope completed by this firm within the last five (5) years. If motorized line-shaft rigging is required on this project, the letter shall indicate the number of line-shaft set provided and installed and the manufacturer of the equipment on each of the five projects. Inspection of one completed installation may be requested by the Architect/Architect's Representative prior to consideration of request to bid. Companies which have no experience in the installation and operation of line-shaft rigging will not be considered. The stage equipment contractor shall have been in business under the same name for five (5) full years preceding the date of this bid doing work similar to the type specified. The decision of the Architect as to the capability of the Bidder to successfully complete and maintain the system, based on this pre-qualification information shall be final.

Pre-Bid request letter shall include a statement that all major items of equipment shall be bid and supplied as specified, or shall contain details of all proposed substitute equipment for review by the Architect/Architect's Representative. Substitute equipment items to include specifications, parts

numbers, and details of interconnection to proposed system. The decision of the Architect/Architect's Consultant as to the acceptability of substitute equipment shall be final.

The Stage Equipment Contractor shall employ only fully trained stage riggers and mechanics, assisted by common laborers, for the erection of the stage equipment. The stage riggers shall be completely familiar with the type of equipment to be installed. A competent Job Superintendent shall be on the job at all times when work is in progress. He shall represent the Stage Equipment Contractor and all directions given by him shall be as binding as if given by the Stage Equipment Contractor.

- 1.10 ACCEPTABLE RIGGING EQUIPMENT MANUFACTURERS: For the purposes of establishing a standard of quality desired on this project, the rigging hardware products of H & H Specialties, Inc. of South El Monte, California are specified. Other stage equipment hardware with prior approval for bidding shall be any and all companies (not an individual) that are contributing members or sustaining members in good standing with United States Institute of Theatre Technology (USITT) at the time of the bid will be considered. Specific items of hardware by any approved manufacturer must still meet the criteria established in these specifications for those items. The rigging hardware products of other manufactures who are not members of USITT may not be used in the construction of this project.

Manufacturers whose equipment has prior approval to be used on this project include the following companies:

- A. Texas Scenic Company, Inc.
- B. J. R. Clancy
- C. H & H Specialties

- 1.11 APPROVED SYSTEMS INSTALLERS: One company shall be responsible for the installation of all aspects of the stage equipment as specified in this section. This shall include but not be limited to all rigging, curtains, tracks, stage lighting fixtures, stage/house dimming, and dimming controls. This company shall have been doing projects of similar magnitude under the same name for at least the last five (5) years. The following companies have prior approval as systems installers:

A. Texas Scenic Company, Inc.

B. J. R. Clancy, Inc.

In order to be considered as a Systems Installer on this project, each Contractor must submit to the Owner at least ten (10) days prior to the date of bid opening a letter expressing his intent to bid. This letter shall include a list of at least five (5) projects of similar size and scope completed by this firm within the last five (5) years. Inspection of one completed installation may be requested by the Owner prior to consideration of request to bid. The decision of the Owner as to the capability of the Bidder to successfully complete and maintain the system, based on this pre-qualification information shall be final.

Pre-Bid request letter shall include a statement that all major items of equipment shall be bid and supplied as specified, or shall contain details of all proposed substitute equipment for review by the Owner. Substitute equipment items to include specifications, parts numbers, and details of interconnection to proposed system. The decision of the Owner as to the acceptability of substitute equipment shall be final.

1.12

DOCUMENTATION

A. SHOP DRAWINGS: Shop drawings and equipment data sheets shall be submitted to the Owner under general provisions within 45 days after award of the contract. Failure to comply with this 45 day requirement shall be cause for disqualification of the selected Contractor and cancellation of contract without cost to the Owner, on the basis that the selected Contractor does not have the ability or intention to comply with the specifications. Approval of submitted equipment shall be obtained prior to equipment purchasing or fabrication. If shop drawings are rejected, correct and resubmit in the manner as specified. All shop drawing information shall be submitted at the same time; no partial submittal will be accepted. Drawings shall indicate complete details, dimensions, product types and locations of all equipment, clearances required, guides, cables, sets, Contractor fabricated equipment, and all other details required to completely describe the work to be performed. Submittals drawings shall be presented at a scale of not less than 1/8" = 1'-0" for conduit plans, 1/4"

for equipment layouts, ½" = 1'-0" for mounting details, and ½" = 1'-0" for plate and panel details. Each sheet to allow space for approval stamps and have the name of the project, the contractors and/or the supplier's name, address telephone number, and the date submitted. Submit the following items for Owner's approval, prior to fabrication:

1. Stage plan view
 2. Stage side section view
 3. Gridiron layout indication headblocks, loftblocks, mules, idlers, etc.
 4. Electrical riser diagrams indicating the necessary control wiring for all dimming, distribution, and controls wire tag number for every connection. Show all terminal blocks with wire numbers and location.
 5. Plan and elevation views indicating all electrical hardware locations and layout
 6. Provide full dimensions for panel layouts with finishes and materials for all custom panels.
 7. Details of installation and erection, including adjoining conditions and necessary clearances.
 8. Indication by arrow and boxed caption of each variation from contract drawing and specifications, except those indicated as acceptable in specifications or on drawings
- B. FABRIC SAMPLES: Submit sample books of each fabric specified, containing standard colors available in the quality of the material specified for the Owner's selection of color and approval. More than one color may be selected. After selection, upon request, submit one square foot samples of each material in each color for final review.
- C. RECORD DRAWINGS AND DATA: Submit in accordance with General Provisions. Also within 30 days of final test and completion of the installation, submit the following to the Owner:
1. Three (3) complete sets of "as built and approved" drawings (rolled, not folded) showing systems and elements as installed, including field modifications and adjustments.
 2. Three (3) sets of maintenance data including a list indicating replacement parts lists for all items of equipment, wiring diagrams, control diagrams, any and all keys for cabinets, racks, key operated switches etc. and complete operation manuals.

3. Three (3) notarized Certificates of Flameproofing for each fabric used.
 4. Three (3) Certificates of Guarantee
 5. Electrical distribution drawing of the theatre in plain view (1/4" = 1'-0") indicating all electrical outlets and their corresponding circuit number dry-mounted to foam board and framed under non-glare glass and mounted on the wall in the control booth
- D. INSTRUCTION OF OWNER PERSONNEL: This contractor or his representative, fully knowledgeable and qualified in systems operation, shall provide eight (8) hours of instruction to the Owner-designated personnel on the use and operation of this System. Designated instruction times shall be arranged through the Owner.
- E. PERMITS: Obtain all permits necessary for the execution of any work pertaining to the installation, and conform in all trades with all applicable local codes and with the National Electric Code. Obtain all permits necessary for operation of any equipment by the Owner.
- F. CLEAN UP: It shall be the responsibility of this Contractor to remove all debris from the building or site caused by his operations to a common trash point or receptacle on the job site, as determined by the Owner.

PART 2 EQUIPMENT

2.01 RIGGING EQUIPMENT

A. GENERAL STANDARDS

1. Paint as required under this section shall be the manufacturer's standard finish and color except as noted.
2. All equipment items shall be new and conform with applicable provisions of Underwriters' Laboratories and American Standards Association.
3. Where acceptable equipment items are specified by catalog number only, device shall meet all published manufacturer's specifications. Where quantities are not given, refer to drawings. Where two or more products are listed, contractor may use either, at his discretion. Equipment shall not be substituted without specific written approval by the Architect/Architect's

Representative under the substitution paragraphs of these specifications.

B. GENERAL RIGGING STANDARDS

1. All turnbuckles, clips, tracks, chains and other items of incidental hardware shall be furnished plated or painted. Wire rope shall be galvanized. Fasteners, chain, and other miscellaneous hardware shall be either cadmium or zinc plated.

2. All materials used in this project shall be new, unused and of the latest design. Refurbished materials are not permitted.

3. In order to establish minimum standards of safety, a minimum factor of 8 shall be used for all equipment and hardware used on this project. In addition, the following factors shall be used:

Cables and fittings	8 Safety Factor
Cable bending ratio	30 times diameter
Tread pressures	500 lbs. for cast iron 1500 lbs. for nylatron 750 lbs. for nylatron injection molded 1500 lbs. for nylatron bar stock 1000 lbs. for steel

Max. fleet angle	1 ½ degrees
Steel	1/5 of yield
Bearings	Two times required load at full for 2000 hours

2.02 STAGE CURTAINS

A. FABRICS

1. Curtains and Valance: Provide 25 ounce Charisma Velour (54" width) as manufactured KM Fabrics, Greenville, South Carolina. 25 ounce Velour from Dazian's, New York, New York, is an acceptable substitute. Color to be selected by Owner.

B. FLAMEPROOFING

1. Fabrics used in fabrication of draperies shall be chemically flameproof with a formula approved Bureau of Standards U.S. Department of Commerce, and finished fabric, after treatment, shall pass such tests as are required by the Fire Marshall of the local Fire Dept. and Owner.

2. A certificate for each type and color of cloth used shall be furnished to the Owner when request for final payment is made.
3. Certificate shall state name of Stage Equipment Contractor, name of firm doing flameproofing treatment, date of treatment, date re-treatment will be required, method of treatment, and the certificate shall be affixed the signature of an officer or authorized representative of the firm furnishing the draperies.
4. The information on certificate shall be notarized by a Notary Public in the State of Mississippi.

C. FABRICATION OF STANDARD DRAPERIES

1. Sew fabrics with box-pleats to 3-1/2" wide heavy-duty upholstery jute webbing, pleats spaced 12" on centers, unless otherwise specified. Use mercerized cotton thread, minimum weight #16, color to match cloth shall be full length and shall be without splices for entire length of the curtain.
2. Properly join panels smooth and free of puckering at seams, hems, and turnbacks.
3. Where completed curtains are to be operated on a traveler track, equip each pleat with a 2" plated harness snaphook mounted to curtain by means of a strap of web-belting to curtain by riveting with not less than 2 tubular rivets per snaphook. Web-belting straps shall pass over front and back sides of pleats, and rivets shall go completely through the web-belting, jute webbing, and all thickness of curtain fabric. Canvas straps, leather straps, grommets and s-hooks, cotter key hooks, etc., shall not be acceptable.
4. Where completed curtains are to be tied to a pipe batten, each pleat shall be equipped with a 30" long #4 braided nylon tieline through a No. 2, or larger brass grommet, each to be on 12" centers located in the box pleats at the webbing.
5. Bottom hems of all curtains shall be 5" and shall be equipped with a separate canvas pocket sewn inside bottom hems in such manner as to have the bottom of the canvas pocket at least 1-1/2" above bottom of curtain hem. Load canvas pocket with #6 galvanized pump chain, secured to prevent bunching and shifting within the pocket.
6. Off-stage vertical hems and center-facing turnbacks of the front curtain and mid-stage shall

be one-half width (27") of material faced back and no sewn hem shall be permitted within these hems. Vertical hems of all masking borders, travelers, and cyclorama curtains shall be 6".

7. Finish curtains properly in the best manner and method of the industry, and after hanging, thoroughly brush to remove dust, visible dirt, loose threads, loose fabric lint, etc. Wrinkles shall be allowed to fall out naturally.
8. Fullness desired for each panel of curtains is indicated by the number of widths specified for each item. Any number of widths less than the number specified will result in re-fabrication of curtains.

2.03 CURTAIN TRAVELER TRACKS

- A. Tracks shall be by H&H Specialties of South El Monte, California. Manufacturer's recommendations on installation of all tracks and related hardware shall be followed. Automatic Devices Inc. of Allentown, PA shall be considered equal.
- B. Track for the Curtains shall be H&H Model #416 Steel Track in two (2) sections, complete with all necessary accessories including #_401_neoprene tired carriers, #_402_master carriers, #_403_6" double end pulley, #_404_6" single end pulley, 1/8" rubber bumpers, rear fold guides floor pulley.

PART 3 INSTALLATION

3.01 GENERAL

- A. Verify that job conditions are ready to receive work of this section. Notify Architect of any existing condition which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.
- B. Verify that field measurements are as shown on shop drawings.
- C. Verify that mechanical, electrical, and other items affecting work of this section are in place and ready to receive the work.

3.02 INSTALLATION

- A. Install using skilled workmen in accordance with manufacturer's printed instructions and recommendations.

- B. Install work in accordance highest industry standards. Handle materials to avoid dents and other damages.
- C. Set and secure materials and components rigid, plumb, and square.

END OF SECTION

SECTION 12.610 AUDIENCE SEATING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fixed audience seating.
- B. Portable audience seating systems.

1.02 RELATED SECTIONS

- A. Division 16 - Electrical for connections to seating junction boxes for aisle lighting power.

1.03 REFERENCES

- A. American Standard Test Materials (ASTM):
 - 1. ASTM B 85: Aluminum Alloy Die Castings
 - 2. ASTM C 423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - 3. ASTM E 795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests.
 - 4. ASTM F 851: Test Method for Self-Rising Seat Mechanisms.
- B. American National Standards Institute (ANSI)/Business and Institutional Furniture Manufacturers Association (BIFMA):
 - 1. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications.
 - 2. ANSI/BIFMA X5.1 2002 - Office Furnishings - General-Purpose Office.
 - 3. ANSI/BIFMA X5.4-2012 - Office Furnishings - Lounge Seating.
- C. State of California, Department of Consumers Affairs, Bureau of Home Furnishings and Thermal Insulation:
 - 1. California Technical Bulletin 117 - requirements, Test Procedures and Apparatus for Testing Flame Retardance of Resilient Filling Materials Used in Upholstered Furniture.
 - 2. California Technical Bulletin 133 - Flammability Test Procedure for Seating Furniture for Use in Public Occupancies.
- D. Code of Federal Regulations:
 - 1. 16 CFR 1610.61 - Clarification of Flammability Standard for Clothing Textiles (CS 191-53).
- E. Hardwood Plywood and Veneer Association (HPVA):
 - 1. HPVA HP-1 - Hardwood and Decorative Plywood.

- F. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA LD 3 - High Pressure Decorative Laminates.
- G. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code (NEC).
- H. Underwriters' Laboratories, Inc. (UL) and Underwriters' Laboratories of Canada (ULC):
 - 1. Requirements for listing and labeling of products.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01340 - Shop Drawings, Product Data and Samples.
- B. Product Data: Provide for all products furnished under this Section. Include dimensions and profiles, electrical connections, wood and metal finishes, and details of construction.
- C. Shop Drawings: Include plans, elevations, sections and details. Show overall plan of fixed seating including aisle spacing and seating layout. Include row to row spacing, row lettering, and chair numbering sequence. Show floor plan and details of ADA/ABA compliance in plan and section. Show method of attachment including anchors and other devices.
 - 1. Develop sightline plan and sections through seating areas using sightlines program and sightline rules. Refer to Drawings.
 - 2. Show fabric selection.
 - 3. Additional options placement (ie. Tablet Arms).
 - 4. Include electrical schematic for aisle lighting.
- D. Samples for Initial Selection
 - 1. Fabric choices.
 - 2. Wood finish selections.
 - 3. Plastic finish sample.
- E. Samples For Verification: Provide manufacturer's samples of the following:
 - 1. Exposed metal component finishes.
 - 2. Plywood panel finish.
 - 3. Row lettering and seat numbering plaques: Provide full size plaques showing base material and lettering font.
- F. Closeout Submittals
 - 1. Operation and Maintenance Data: For adjusting, repairing and replacing components and accessories.
 - 2. Warranty: Submit manufacturer's sample warranty.

- G. Product Certificates: Provide manufacturer's certification of flame-retardant treatment (if required).
- H. Cleaning and Maintenance Information: Provide instructions for cleaning, adjusting, repairing, and replacing fixed audience seating.
- I. Warranty: Copy of manufacturer's warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5 years experience in manufacture of similar products in use in similar environments, including project size, and complexity, and with the production capacity to meet the construction and installation schedule.
- B. Installer Qualifications: Manufacturer's authorized representative, trained and approved for installation of units required for this Project.
- C. Source Limitations: Obtain components and accessories through one source from a single approved manufacturer.
- D. Fire-Test-Response Compliance:
 - 1. Fabric: Class 1 according to DOC CS 191 and 16 CFR 1610.61, tested according to California Technical Bulletin 117.
 - 2. Cushioning: California Technical Bulletin 117.
 - 3. Full-Scale Fire Test: California Technical Bulletin 133. (If required).
- E. Electrical Components: Listed and labeled per NFPA 70, Article 100 by a testing agency acceptable to authorities having jurisdiction.
- F. Regulatory Requirements: Where components are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities".
- G. Mockups: Build mockups to set standards for fabrication. Show fabric selection, wood and metal finishes selections and aesthetic effect.
 - 1. Configuration: A typical two-seat unit with aisle and row seat.
 - 2. Approved mockups will be returned to the manufacturer upon request, and may become part of Project if in as-manufactured condition at time of Substantial Completion.

H. Field Dimensioning: After approval of submittals but prior to fabrication, confirm dimensions of fixed audience seating space, including features that will affect installation. Confirm location of electrical rough-in.

1.06 PRE-INSTALLATION MEETINGS

A. Convene at the Project site minimum two weeks prior to starting work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original unopened containers with manufacturer's labels attached.

B. Handle fixed audience seating during installation to prevent damage. Replace any seating damaged during installation.

C. Handle and install units to avoid damage.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install lockers until spaces are enclosed and weather tight, wet work in spaces is complete and dry, HVAC system is operating and maintaining ambient temperature at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify field measurements as indicated on Shop Drawings. Where measurements are not possible, provide control dimensions and templates.

1. Coordinate locations of electrical junction boxes.

C. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

D. Where fixed audience seating is anchored to new concrete, allow for curing of concrete before seating is delivered.

1.09 WARRANTY

A. Special Warranty: Manufacturer's written warranty indicating manufacturer's intent to repair or replace components of audience seating that fail in materials or workmanship.

1. Failures include, but are not limited to, the following:

- a. Fracturing or breaking of unit components which results from normal wear and tear and normal use other than vandalism.
 - b. Delamination or other failures of glue bond of components.
 - c. Warping of components not resulting from leaks, flooding, or other uncontrolled moisture or humidity.
- 2. Damage from deliberate destruction and vandalism is excluded.
 - 3. Warranty Period for fixed audience seating: Five years from date of Substantial Completion.

1.10 EXTRA MATERIALS/ATTIC STOCK

- A. Furnish the following extra materials from the same manufacturing run as the original products that match products installed. Package with protective coating and identified with product labels.
 - 1. Full-size units of the following seating components equal to 5 percent of amount installed for each type and finish installed, but no fewer than two units:
 - a. Arm standards (both center and end standards).
 - b. Wooden/Plastic seat back and cushion Covers
 - c. Seat bottom.
 - d. Lighting Components devices.
 - e. Fabric.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Navetta Design - Pensa
- B. Other approved products:
 - 1. Borgo - Moncton chair.
 - 2. Figueras - 13108 Lyon
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.02 MATERIALS AND FINISHES

- A. Hardwood Lumber: Clear Beech, plain-sawn or sliced.
- B. Beech Veneer Hardwood Plywood: HPVA HP-1, 11-ply, AA-grade, rotary cut. The seat back must be a minimum of 13-ply 11/16 inch (17.5 mm) thick plywood. The seat bottom must be a minimum of 7-ply 7/16 inch (11 mm) thick veneer plywood. Plywood edges are stained to match the veneered faces. The arm caps on the standards shall be solid beech wood.

- C. Medium Density Fiberboard: ANSI A208.2, Grade MD.
- D. Wood Finishes: Manufacturer's standard finish and stain.
- E. High-Pressure Decorative Laminate: NEMA LD-3, Grade VGS.
- F. Plastic: Polypropylene copolymer IF-727. High impact, injection molded polypropylene. Polypropylene outer seat and back panel includes a flange around the sides to provide fabric protection. Textured finish for an attractive and low maintenance surface.
- G. Metal Finishes: Manufacturer's standard baked-on powder coating: electrostatically applied, baked-polymer, thermosetting powder finish.
- H. Cushion Foam: Flexible, cellular, cold-molded, contoured polyurethane foam, flame-retardant-treated.
- I. Row/Seat/Donor Plaques: available upon request.
- J. Aisle Lighting: Tempo Lighting
 - 1. Transformers as required.
 - 2. Aisle lights shall be low voltage system.
 - 3. Aisle lighting shall be inaudible.

2.03 FIXED AUDIENCE SEATING

- A. Basis-of-Design: Pensa Seating series as manufactured by Navetta Design
- B. Fixed Audience Seating: Audience seating with steel support, arm rest, and maintenance free self-lifting seats.
 - 1. Upholstery: Available CAL-TB-117 Flame-retardant Treated
 - a. Color and Pattern: As selected from manufacturer's standard fabrics.
 - 2. Chair Width: Width 21 inches (533 mm) measured from center of armrest to center of opposite armrest.
 - 3. Chair Width: Width 22 inches (559 mm) measured from center of armrest to center of opposite armrest.
 - 4. Chair Width: Width 23 inches (584 mm) measured from center of armrest to center of opposite armrest.
 - 5. Chair Width: Width 24 inches (610 mm) measured from center of armrest to center of opposite armrest.

6. Chair Width: Width 25 inches (635 mm) measured from center of armrest to center of opposite armrest.
 7. Stanchion: 40mmx80mmx3mm thick oval steel tube weldment.
 - a. Epoxy powder coat finish
 8. Seat
 - a. Fully Upholstered Seat Bottom: Fully upholstered outer seat panel includes an inner 1/2 inch (12 mm) hardwood plywood seat panel to provide supporting structure.
 - 1) Seat Rise Mechanism: Maintenance free gravity assist with noise dampening seat stops.
 - 2) Cushion foam: High resiliency cold-molded polyurethane is a minimum of 2 inches (50 mm) thick.
 9. Back
 - a. Fully Upholstered Seat Back: Fully upholstered outer back panel includes an inner 5/8 inch (16 mm) hardwood plywood seat panel to provide supporting structure. Fabric conceals attachment brackets and hardware.
 - b. Polypropylene Kick Panels: Injection molded plastic panels cover the lower portion of the reverse side of the seat back, protecting the upholstery and concealing the attachment brackets and hardware.
 10. Armrests
 - a. Polypropylene Armrest: High impact polypropylene.
 - b. Die-cast aluminum modular armrest system allows for in the field conversion from standard armrest to tablet armrest
 11. Tablet: Anti-panic tablet component of modular armrest system
 - a. Injection molded plastic tablet offers 100 square inches of writing surface
 - b. Cast aluminum pivot mechanism allows for single motion, anti-panic closure to stowed position.
 12. Power system: integrated into the seat stanchion
 - a. 120v AC power available
 - b. USB power available
- C. Fabrication
1. Fabricate floor standards to fit slope of floor so that standards are plumb and maintain chairs at the required relationship to the vertical.

2. Upholstery: Fabricate upholstered chairs with fabric free of creases and wrinkles. Install warp and woof of fabric and pattern in consistent direction.
- D. ADA/ABA
1. Available with free standing base.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates with Installer to verify conditions meet requirements for seating installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install seating units level, plumb, true; and with pitch of seating as indicated on the shop drawings.
- B. Install seating units with mounting standards aligned from the last to first row as indicated.
 1. Vary seat widths to optimize spectator sight lines.
 2. Vary seat spacing to optimize spectator sight lines.
 3. Vary seat both width and spacing to optimize spectator sight lines.
- C. Install rows with smooth curvature.
- D. Adjust seating so that operating hardware works smoothly and quietly.
- E. Install wiring ready for final connections. Align wiring connections with rough-in installation.

3.03 ADJUSTING AND CLEANING

- A. Adjust hardware and automatic lifters when needed.
- B. Clean and vacuum seating standards and fabrics.
- C. Touch up marred surfaces. Replace seating units that are not acceptable to Architect.

END OF SECTION

SECTION 12.700 MULTIPLE SEATING SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Table systems with swingout seating
 - 1. Fixed Table System with swingout seating: Navetta Symmetra Plus System.
 - 2. Fixed Table System at Room 306: Navetta Symmetra System
 - 3. Extent: Systems to be as indicated on drawings and as specified

1.02 PRODUCT DESCRIPTION

- A. Seat/Table Requirements:
 - 1. Pedestal: provide table and supports providing allows fixed work surface with open access, supported by pedestals.
 - 2. Seating: Provide modular seating supported by swing arms on either side of each support pedestal, seats to independently swing out for access and swing back adjacent to table top when unoccupied.
 - 3. Power and Data Distribution System: Modular data and electrical system housed in flexible conduit. All power system components shall be UL approved, including the steel pedestal table leg used for power entry, which shall be certified as a "UL Recognized Component," and will have appropriate labeling documenting that approval.

1.03 SUBMITTALS

- A. General: Submit listed submittals in accordance with Contract and standard Submittals Procedures.
- B. Product Data: Submit manufacturers' product data, including product specification sheets, for products specified.
- C. Shop Drawings: Submit shop drawings showing seating layout, seat-numbering scheme, chair sizes and aisle widths.
- D. Samples: Submit verification samples of finishes, colors and textures specified for each exposed material.
- E. Quality Assurance Submittals; Submit the following:
 - 1. Certificates: Product certificates signed by manufacturer certifying materials comply with

- specify performance characteristics and criteria and physical requirements.
2. Installer Qualifications: Submit certification indicating installer is qualified to install manufacturer's seating.
 3. Bidder Qualifications: Submit certification, prior to drawing completion, indicating site has been inspected for any conditions that may affect the assembly or installation of products required.

1.04 WARRANTY

- A. Project Warranty: Refer to "Conditions of the Contract" to project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owners acceptance:
 1. Manufacturer's standard warranty documents executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owners may have under Contract Documents.
 2. Warranty period; Ten (10) year warranty on understructure and seating shells (when utilized) from defects of manufacture and workmanship, commencing on Date of Substantial Completion.
 3. Warranty will be null and void if products are installed on flooring not meeting minimum structural requirements as specified by manufacturer.

PART 2 PRODUCTS

2.01 TABLE SYSTEM

- A. Manufacturer: Navetta division of Shuttlesystem LLC
- B. Product: Symmetra Plus Fixed Table System
- C. Other approved manufacturers/products:
 1. Borgo - Thesi lecture hall system
 2. Falcon
- D. Product specifications
 1. Pedestal Support
Construction: Pedestals shall be constructed of 11 gauge steel tubing of oval cross-section measuring 3.15" x 1.57".
 2. Floor mount
Pedestal shall be computer-controlled welded to a .25" thick steel base plate measuring 8" x 4" with

- four slotted holes for mounting pedestal to floor with anchor bolts.
3. Base cover
Base plate to be fully covered after mounting with two-piece cover constructed of injection molded toughened nylon, attached with two machine screws.
 4. Table mount
Top mount bracket shall be constructed of 11 gauge steel with four attaching bolts allowing attachment to pedestal and adjustment for variations in floor surface to provide alignment of adjacent tabletops without shimming tops. Bracket shall provide six mounting holes for attaching table top and designed to accept optional power and/or data electrical system.
 5. Top shroud
Top mount bracket will be covered by shroud with rounded edges constructed of injection molded ABS, attached with machine screws.
 6. Metal Finish
Metal components shall have powder-coat finish in finish specified.
 7. Table Configuration
Table tops shall be designed to be assembled into continuous surface in continuous radius configuration. Adjacent tops to be joined with two mechanical clamping fasteners. Tops shall have cutouts for tabletop power modules when specified. Manufacturer shall be FSC (Forest Stewardship Council) chain-of-custody Certified.
 8. Table Top Construction
Table tops shall be nominal 1.25" thick warp-resistant construction with 1.125" particleboard center core sandwiched between .040" high pressure laminate top surface and phenolic backing surface. Assembly to be permanently bonded under continuous pressure in hot press.
 9. Table Top Edge treatment
Edges shall be finished as specified, using 3mm PVC.
 10. Table Top Attachment
Table tops to attach to pedestal brackets with six #12 lag bolts.
 11. Modesty Panel Construction
Modesty panels shall be constructed of .8" thick nominal particle board sandwiched with bonded

high-pressure laminate as specified and phenolic backing sheet, or available perforated metal of specified material, pattern and finish. Modesty panel shall be a full height radiused continuous panel. Straight segmented panels are not acceptable.

12. Modesty Panel Attachment
Modesty panels shall interlock into machined recess in underside of table top surface and attach with supplied rigid metal brackets and hardware. Standard configuration provides .5" clearance between adjacent modesty panels, continuous configuration optional.
13. End Panel Construction
If specified, end panels shall be constructed of .8" thick nominal particle board sandwiched with bonded high-pressure laminate as specified and phenolic backing sheet, or available perforated metal of specified material, pattern and finish.
14. End Panel Attachment
End Panels shall attach with supplied rigid metal brackets and hardware.
15. Seat Support Mechanism
Seat support arms shall be constructed of 11 gauge oval steel tubing formed to a radius, with industry-standard taper receiver to accept chair cylinder. Arms on either side of the support pedestal shall pivot independently from a steel kingpin mounted in a die cast aluminum housing with powder coat finish. A field-adjustable torsion spring shall be implemented to automatically return the seat adjacent to the table top when not occupied.
16. Seat Specifications
Product: Navetta's Avalon chair. Upholstered seat with polypropylene back.
17. Computer Room 306 - Custom Table - 60 Positions
Product: Symmetra Table System (Loose chair seating not swingout) design. Each position shall have a ¼" glass panel for viewing of monitor. The monitor will be held in place by a metal bracket (black). Size of bracket and glass viewing screen to be determined by owner. Pull out keyboard tray to be furnished under this specification. Avalon (see above) with five-star base to be provided under this specification.

MULTIPLE SEATING SYSTEMS

PART 3 INSTALLATION, EXECUTION AND WORKMANSHIP

3.01 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's installation instructions, including bulletins, product catalog, installation instructions and product carton instructions for installation.

3.02 EXAMINATION

- A. Site Verification: Prior to installation verify, with installer present, that substrates and conditions comply with the requirements for construction tolerances and materials properties as they affect anchors and fasteners and location of junction boxes.
- B. Repair: Do not proceed until unsatisfactory components or facility conditions have been corrected.

3.03 INSTALLATION

- A. Installation: Install following manufacturers printed instructions for installation and using manufacturer recommended hardware and fasteners. Tables in curbed rows shall be installed at smooth radius.
- B. Repair: Repair minor abrasions and imperfections in painted surfaces with a coating that matches the factory- applied finish.

3.04 CLEANING AND PROTECTION

- A. Cleaning: Clean Product in accordance with manufacturer instruction prior to Owner's acceptance. Remove construction debris, including cartons from project site and legally dispose of debris.
- B. Protection: Protect installed product and finished surfaces from damage during construction.

END OF SECTION

SECTION 14.210 ELECTRIC TRACTION ELEVATORS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Electric Traction Elevators.
- B. Industry and government standards:
 - 1. ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities
 - 2. ADAAG -Accessibility Guidelines for Buildings and Facilities
 - 3. ANSI/NFPA 70, National Electrical Code
 - 4. ANSI/NFPA 80, Standard for Fire Doors and Fire Windows
 - 5. ASME/ANSI A17.1, Safety Code for Elevators and Escalators.

1.02 DESCRIPTION OF ELEVATORS

- A. Elevator Equipment: KONE EcoSpace gearless traction elevator
- B. Elevator Equipment shall conform to the requirements of seismic zone: as indicated on Structural Drawings
- C. Quantity of Elevators: as indicated on Drawings
- D. Landings: E1 = 3; E2 = 4
- E. Openings: E1 = 3 Front; E2 = 4 Front
- F. Travel: as indicated on Drawings
- G. Rated Capacity: E1 = 3,500 lbs; E2 = 5,000 lbs
- H. Rated Speed: 150 fpm (minimum)
- I. Cab Height: 8'-0"
- J. Entrance Width: E1 = 3'6"; E2 = 4'0"
- K. Entrance Height: 7 ft'
- L. Maintenance Service Period: 24 Months
- M. Machine Location: Inside the hoistway mounted on car guide rail
- N. Control Space Location: where indicated on Drawings
- O. Clear Hoistway Width: E1=8'-6"w x 6'-11"d; E2=7'-4"w x 10'-2-1/4"d

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product literature for each proposed system.
 - 1. Cab design, dimensions and layout.
 - 2. Layout, finishes, and accessories and available options.
 - 3. Controls, signals and operating system.
 - 4. Color selection charts for cab and entrances.

- B. Shop Drawings
 - 1. Clearances and travel of car.
 - 2. Clear inside hoistway and pit dimensions.
 - 3. Location and layout of equipment and signals.
 - 4. Car, guide rails, buffers and other components in hoistway.
 - 5. Maximum rail bracket spacing.
 - 6. Maximum loads imposed on building structure.
 - 7. Hoist beam requirements.
 - 8. Location and sizes of access doors.
 - 9. Location and details of hoistway door and frames.
 - 10. Electrical characteristics and connection requirements.
- C. Operation and maintenance data
 - 1. Provide manufacturer's standard maintenance and operation manual.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Minimum of ten years experience in the fabrication, installation and service of elevators of the type and performance of the specified. The manufacturer shall have a documented quality assurance program.
- B. Installer: The equipment manufacturer shall install the elevator.
- C. Inspection and Testing: In accordance with requirements of local jurisdiction, obtain required permits, inspections and tests.

1.05 DELIVERY, STORAGE AND HANDLING

- A. If the construction site is not prepared to receive the elevator equipment at the agreed ship date, the General Contractor shall be responsible to provide a safe, dry, and easily accessible storage area on or off the premises. Additional labor costs for double handling will be the responsibility of the general contractor.
- B. Delivered elevator materials shall be stored in a protected environment in accordance with manufacturer recommendations. A minimum storage area of 10 feet by 20 feet is required adjacent to the hoistway.

1.06 WARRANTY

- A. Provide manufacturer warranty for a period of one year. The warranty period is to begin upon Substantial Completion of the Contract. Warranty covers defects in materials and workmanship. Damage due to ordinary

use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

1.07 MAINTENANCE SERVICE

- A. The elevator manufacturer shall provide maintenance service consisting of regular examinations and adjustments of the elevator equipment for a period of 24 Months after date of substantial completion. Replacement parts shall be produced by the original equipment manufacturer.
- B. Maintenance service be performed during regular working hours of regular working days and shall include emergency 24-hour call back service.
- C. Maintenance service shall not include adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Provide AC gearless machine room-less elevator systems subject to compliance with the design and performance requirements of this specification. Elevator manufacturers may include but are not limited to one of the following:
 - 1. Basis of Design: Kone, Inc. EcoSpace
 - 2. Other acceptable machine room-less products:
 - a. Otis Elevator Co. - Gen2
 - b. Schindler Elevator Corp. - 400A
 - c. Thyssen Krupp Synergy - 85S

2.02 EQUIPMENT: CONTROL COMPONENTS AND CONTROL SPACE

- A. Controller: Provide microcomputer based control system to perform all of the functions.
 - 1. All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidental contact in a situation where the controller doors are open.
 - 2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.
 - 3. Provide a serial cardrack and main CPU board containing a non-erasable EPROM and operating system firmware.

- 4. Variable field parameters and adjustments shall be contained in a non-volatile memory module.
- B. Drive: Provide Variable Voltage Variable Frequency AC drive system to develop high starting torque with low starting current.
- C. Controller Location: Locate controller(s) in an integral cabinet adjacent to the entrance frame at the top landing of the elevator.

2.03 EQUIPMENT: HOISTWAY COMPONENTS

- A. Machine: AC gearless machine, with permanent magnet synchronous motor, direct current electro-mechanical disc brakes and integral traction drive sheave, mounted to the car guide rail at the top of the hoistway.
- B. Governor: Friction type over-speed governor rated for the duty of the elevator specified.
- C. Buffers, Car and Counterweight: Polyurethane buffer.
- D. Hoistway Operating Devices:
 - 1. Emergency stop switch in the pit
 - 2. Terminal stopping switches
 - 3. Emergency stop switch on the machine
- E. Positioning System: System consisting of magnets and proximity switches.
- F. Guide Rails and Attachments: Steel rails with brackets and fasteners.

2.04 EQUIPMENT: HOISTWAY ENTRANCES

- A. Hoistway Entrances
 - 1. Sills: extruded.
 - 2. Doors: Hollow metal construction with vertical internal channel reinforcements.
 - 3. Fire Rating: Entrance and doors shall be UL fire-rated for 1-1/2 hour.
 - 4. Entrance Finish: Brushed Stainless Steel.
 - 5. Entrance Markings Jamb Plates: Provide standard entrance jamb tactile markings on both jambs, at all floors. Plate Mounting: Refer to manufacturer drawings.

2.05 EQUIPMENT: CAR COMPONENTS

- A. Car Frame: Provide car frame with adequate bracing to support the platform and car enclosure.
- B. Platform: Platform shall be all steel construction.
- C. Car Guides: Provide guide-shoes mounted to top and bottom of both car and counterweight frame. Each guide-shoe assembly shall be arranged to maintain

constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.

D. Steel Cab

1. Car Wall Finish: Brushed stainless steel.
2. Car Front Finish: Brushed stainless steel.
3. Car Door Finish: Brushed stainless steel.
4. Ceiling
 - a. Aurora Standard Translucent Panels suspended ceiling shall consist of white translucent polycarbonate panels set in frame of extruded natural satin finish with fluorescent lighting fixtures.
5. Handrail
 - a. Round tube brushed stainless steel of 3/8-inch thick by 2 inches wide.
6. Flooring: See division 9 Section "Terrazzo".
7. Threshold: Aluminum

E. Emergency Car Signals

1. Emergency Siren: Siren mounted on top of cab that is activated when the alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.
2. Emergency Car Lighting: Provide emergency power unit employing a 12-volt sealed rechargeable battery and totally static circuits shall illuminate the elevator car and provide current to the alarm bell in the event of building power failure.
3. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

F. Ventilation: Fan.

2.06 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: Provide car operating panel with all push buttons, key switches, and message indicators for elevator operation.

1. Car operating panel shall contain a bank of round, mechanical, illuminated buttons marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. Buttons have amber illumination (halo) and shall be vandal resistant. All buttons to have raised text and Braille marking on left hand side.

- The car operating display panel shall be a 7-segment amber display. All texts, when illuminated, shall be amber. The car operating panel shall have a brushed stainless steel finish.
2. Additional features of car operating panel shall include:
 - a. Car Position Indicator within operating panel (amber).
 - b. Elevator Data Plate marked with elevator capacity and car number on car top.
 - c. Help button markings with raised markings.
 - d. In car stop switch per local code.
 - e. Firefighter's hat.
 - f. Firefighter's Phase II Key-switch.
 - g. Call Cancel Button.
 - h. Pre-programmed integrated ADA phone (complete description of krms features included as standard)
 - i. Help Button/Communicator. Activation of help button will initiate two-way communication between car and a location inside the building, switching over to alternate location if call is unanswered, where personnel are available to take the appropriate action. Visual indicators are provided for call initiation and call acknowledgment.
 - j. Firefighter's Phase II emergency in-car operating instructions.
 - k. Provide keyed control access on Elev 2 to access the 4th Floor since this is restricted area for maintenance purposes.
 - B. Hall Fixtures: Wall mounted hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Wall mounted hall fixtures shall have a brushed stainless steel finish.
 1. Hall fixtures shall feature round, mechanical, illuminated buttons in raised fixture housings. Hall fixtures shall correspond to options available from that landing. Buttons shall be flat flush in vertically mounted fixture. Hall fixtures should not be jamb-mounted. Hall Lanterns and hall indicators shall feature amber illumination, all numbers will be 7-segment amber display.
 - C. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in

which the car is to travel and a chime will sound. The chime will sound once for up and twice for down.

2.07 EQUIPMENT: ELEVATOR OPERATION AND CONTROLLER

A. Elevator Operation

1. Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.

2. Zoned Car Parking.

3. Relative System Response Dispatching.

B. Standard Operating Features to include:

1. Full Collective Operation

2. Fan and Light Control.

3. Load Weighing Bypass.

4. Ascending Car Uncontrolled Movement Protection

5. Top of Car Inspection Station.

C. Additional Operating Features to include:

1. Provision for Card Reader in Car (Card Reader provided and Installed by others).

D. Elevator Control System for Inspections and Emergency

1. Provide devices within controller to run the elevator in inspection operation.

2. Provide devices on car top to run the elevator in inspection operation.

3. Provide within controller an emergency stop switch to disconnect power from the brake and prevents motor from running.

4. Provide the means from the controller to mechanically lift and control the elevator brake to safely bring car to nearest available landing when power is interrupted.

5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.

6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.

7. Provide the means for the control to reset elevator earthquake operation.

2.08 EQUIPMENT: DOOR OPERATOR AND CONTROL

A. Door Operator: A closed loop permanent magnet VVVF high-performance door operator shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at

both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

- B. The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by local code.
- C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.
- D. Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.
- E. Electronic Door Safety Device. The elevator car shall be equipped with an electronic protective device extending the full height of the car. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Field measure and examine substrates, supports, and other conditions under which elevator work is to be performed.
- B. Do not proceed with work until unsatisfactory conditions are corrected.
- C. Prior to start of Work, verify hoistway is in accordance with shop drawings. Dimensional tolerance of hoistway from shop drawings: -0 inches +2 inches.

Do not begin work of this section until dimensions are within tolerances.

- D. Prior to start of Work, verify projections greater than 2 inches (4 inches if ASME A17.1/CSA B44 2000 applies) must be beveled not less than 75 degrees from horizontal.
- E. Prior to start of Work, verify landings have been prepared for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.
- F. Prior to start of Work, verify elevator pit has been constructed in accordance with requirements, is dry and reinforced to sustain vertical forces, as indicated in approved submittal. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.
- G. Prior to start of Work, verify control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including Sleeves and penetrations.
- H. Verify installation of GFCI protected 20-amp in pit and adjacent to each signal control cabinet in control space.

3.02 PREPARATION

- A. Coordinate installation of anchors, bearing plates, brackets and other related accessories.

3.03 INSTALLATION

- A. Install equipment, guides, controls, car and accessories in accordance with manufacturer installation methods and recommended practices.
- B. Properly locate guide rails and related supports at locations in accordance with manufacturer's recommendations and approved shop drawings. Anchor to building structure using isolation system to minimize transmission of vibration to structure.
- C. All hoistway frames shall be securely fastened to fixing angles mounted in the hoistway. Coordinate installation of sills and frames with other trades.
- D. Lubricate operating system components in accordance with manufacturer recommendations.
- E. Perform final adjustments, and necessary service prior to substantial completion.
- F. The installation is required to be inspected by an Elevator Inspector licensed by the State of Mississippi. The inspector shall be hired by the Owner, however, the inspection shall be coordinated

under this contract. Contractor shall correct all Work required by the Elevator Inspector prior to the elevator being accepted and put into service

3.04 CONSTRUCTION

A. Interface with Other Work

1. Guide rail brackets attached to steel shall be installed prior to application of fireproofing.
2. Coordinate construction of entrance walls with installation of door frames and sills. Maintain front wall opening until elevator equipment has been installed.
 - a. Ensure adequate support for entrance attachment points at all landings.
 - b. Coordinate wall openings for hall push buttons, signal fixtures and sleeves. Each elevator requires sleeves within the hoistway wall.
 - c. Coordinate emergency power transfer switch and power change pending signals as required for termination at the primary elevator signal control cabinet in each group.
 - d. Coordinate interface of elevators and fire alarm system.
 - e. Coordinate interface of dedicated telephone line.

3.05 TESTING AND INSPECTIONS

- A. Perform recommended and required testing in accordance with authority having jurisdiction.
- B. Obtain required permits and provide originals to Owner's Representative.

3.06 DEMONSTRATION

- A. Prior to substantial completion, instruct Owner's Representative on the proper function and required daily maintenance of elevators. Instruct personnel on emergency procedures.

END OF SECTION

SECTION 15010

GENERAL PROVISIONS

10.1 INSTRUCTIONS

- A. The General Conditions, Information to Bidders, Special Conditions, and other pertinent documents issued by the Architect are a part of the Contract Documents and shall be complied with in every respect. Reference Division 1 for information regarding contract closeout, shop drawings, substitution and product options and general conditions.
- B. This Contractor shall examine the general construction drawings, the structural drawings, the electrical drawings, and lay out his work accordingly to avoid conflict.
- C. THIS CONTRACTOR SHALL VISIT THE SITE IN ORDER TO FAMILIARIZE HIMSELF WITH EXISTING WORKING CONDITIONS. FAILURE TO DO SO SHALL NOT RELIEVE CONTRACTOR OF RESPONSIBILITY OF MAKING CHANGES REQUIRED BY CONDITIONS ENCOUNTERED ON SITE.
- D. This Contractor shall conform to standards prescribed by City, County, and State regulations or ordinances having jurisdiction. Execution of the Contract Document indicates Contractors knowledge of above regulations or ordinances and any changes that may be necessary to conform to such regulations or ordinances shall be made by this Contractor without extra cost to the Owner.
- E. This Contractor shall provide all items, articles, materials, operations, or methods listed, mentioned or scheduled on the Drawings, and/or herein, including all labor, materials, equipment and incidentals necessary, required, or implied, for the completion of the various systems.
- F. Permits required for the installation of the work, as well as all authorized code inspections, construction fees, meters and assessments shall be arranged for and paid for by the Contractor. Final "meter deposits", if required by utility for permanent service, shall be made by Owner.

10.2 DRAWINGS

- A. The drawings indicate the extent and general arrangement of the various systems. If any departure from these drawings is necessary, descriptions of these departures and a statement of the reasons therefore shall be submitted to the Architect for approval.
- B. These drawings and specifications shall be considered a part of this Contract. Should an error or omission occur in either or both the drawings and specifications, or conflict one with the other, this Contractor shall not avail himself of such unintentional error, omission or conflict, but shall have same explained to him and adjusted before signing the Contract or proceeding with the work.
- C. Shop drawings and required field drawings shall be prepared by the Contractor in quintuplicate and hereinafter specified or required by the drawings. Shop drawings will include all dimensions, grades, materials, etc., pertinent to installation. Equipment rooms shall be drawn at large scale and shall show equipment, foundation, piping, and clearances

for maintenance, etc. The shop drawings will be coordinated with the work of related trades and shall be submitted for approval before installation is begun.

- D. Contractor agrees that Shop Drawing Submittal processed by the Architect or Engineer are not Change Orders; that the purpose of Shop Drawing Submittal by the Contractor is to demonstrate to the Architect or Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. Contractor further agrees that if deviations, discrepancies or conflicts between Shop Drawings and Specifications are discovered either prior to or after Shop Drawing Submittal are processed by the Architect or Engineer, the Contract Drawings and Specifications shall control and shall be followed.

10.3 LIST OF MATERIALS, FIXTURES AND EQUIPMENT

- A. WITHIN THIRTY (30) DAYS AFTER AWARD OF CONTRACT, EXCEPT AS NOTED, SUBMIT A COMPLETE LIST OF MATERIALS, FIXTURES AND EQUIPMENT TO THE ARCHITECT FOR APPROVAL. There shall be minimum five (5) copies of data on each item and they shall be complete with names and addresses of manufacturers, catalog and model numbers, trade names, capacities and all other information required. DO NOT SUBMIT PARTIAL LISTS FROM TIME TO TIME. Approval shall be based on manufacturer's published ratings only.

- B. Contractor shall not delegate the authority to material supply houses to present data for approval. This shall be done by the Contractor. Data shall be presented in hard backed 3-ring binders indexed and tabbed for ready reference to any article, material, equipment unit and the like.

- C. Contractor shall submit manufacturers' data and brochures on the following items:

Valves.

Piping Specialties (including suction diffusers, expansion tank, air separator, water flow measuring devices, thermometers, pressure gauge, pressure reducing valves, back flow preventors, pressure relief valves).

Vibration isolation - Indicate type and rating for each application. Coordinate with equipment manufacturers.

Fire protection - All valves, accessories, and materials. Submit drawing of piping layout with sizes indicated and sprinkler head location coordinated with lights and air distribution. Submit copy of local fire marshal's approval. Submit hydraulic calculations for approval.

FM-200 Fire Suppression System.

Plumbing fixtures, trim and accessories.

Water heater.

Hoods.

Boilers.

Pumps.

Air handling units with coils and accessories.

Computer room units.

Control and back draft dampers.

Exhaust fans.

Air distribution devices and accessories.

Controls and instrumentation - including energy management system, sensors, controllers, panels, switches, relays, etc. Include detailed control and flow schematic drawings indicating all sensors and controllers. Submit complete detailed wiring diagrams of all components of control and energy management systems. Submission of controls and instrumentation shall be within 60 days after award of contract.

- D. Complete set of mechanical submittals shall be transmitted to the Architect in three ring hard binders, all sets identical, with tabbed dividers indicating equipment, "Pump", "Piping Specialties", etc. for each group. Partial submittals will not be acceptable. Operating and Maintenance Manuals (two total) shall be bound and tabbed similar to the mechanical submittals.

10.4 SUBSTITUTION OF MATERIALS

- A. Where a definite material or unit of equipment is specified without mention of other manufacturers or followed by the phrase "or approved equal" it is the intent that this item shall be furnished with no substitutions. When other manufacturers are listed or if the phrase "or approved equal" is used to set a definite standard of quality and/or design and is not used to discriminate against any product of another manufacturer.
- B. Open competition is expected, but in all cases, complete data must be submitted on all proposed substitutions and samples shall be submitted for comparison and test when requested by the Architect or Engineer.
- C. It shall be the responsibility of the Contractor to ascertain if the substitute items will fit into the space allotted as conveniently as the items specified. Any changes to the building or system design necessary shall be arranged for in writing before material is ordered. All costs involved in making such changes shall be borne by the Contractor. If such changes are deemed inadvisable by the Architect or Engineer, the Contractor shall install items specified even though substitute item had been previously approved. Architect's or Engineer's approval of a substitute is for performance and/or design only.

10.5 INSTALLATION DIRECTIONS

- A. Obtain manufacturer's printed installation directions to aid in properly executing work on equipment requiring such directions as directed by the Architect or Engineer. Submit such directions to Architect or Engineer for approval prior to time of installation of equipment.

10.6 STARTING AND INSTRUCTIONS

- A. All equipment and systems shall be tested as hereinafter specified.
- B. Furnish a competent technician to supervise the starting, adjusting and test of all equipment and to train the operator in the operation of the system. Where specified, certain major items of equipment shall be installed under the supervision of and tested by a specialist furnished by the manufacturer of the equipment. Such specialist train the operator in the use of his equipment.
- C. Contractor shall furnish operating and maintenance instructions for each and every piece of equipment supplied by him together with four (4) copies of spare parts lists. Information shall be neatly bound in two (2) - three ring binders, indexed and labeled for each piece of equipment supplied. Contractor will spend sufficient time with the operator to acquaint him with the complete operation of the systems. Provide framed, glass enclosed, typewritten instructions, easily read, explaining exactly the procedure to be followed in starting up, and in shutting down the systems for each of the various control cycles. Operators, such as switches, pushbuttons, changeovers, etc., shall be numbered and referred to by number and function in the operating instructions.

10.7 PROTECTION OF EQUIPMENT AND MATERIALS

- A. Responsibility for care and protection of equipment and material under this Contract rests with this Contractor until equipment or materials have been tested and accepted.
- B. All pipe ends, valves and parts of equipment left unconnected permanently or temporarily, shall be capped, plugged or properly protected to prevent entry of foreign matter.
- C. All duct being installed shall have closed off ends at the end the work day, for protection to prevent any foreign matter from entering ductwork overnight.
- D. All ductwork delivered on job but not installed will be covered completely from outside elements and stored in locations elevated from the floor slab/deck on pallets to prevent exposure to any possible standing water. No ductwork is to be stored outside.

SECTION 15020

CODES AND STANDARDS

20.1 APPLICABLE CODES

All work performed and all material used shall conform to the standard as set up by the current edition of the following codes:

- A. ASHRAE - ASHRAE Guide latest edition.
- B. AGA - Standards for Installation of Gas Appliances and Piping.
- C. International Gas Code.
- D. International Electrical Code.
- E. International Mechanical Code.
- F. International Plumbing Code.
- G. SMACNA Sheet Metal & Air Conditioning Contractors National Association.
- H. National Fire Codes - NFPA - 90-A, NFPA - 96, NFPA -101.
- I. International Building Code.
- J. International Federal Accessibility Standards.
- K. Recommendations for Accessibility to Serve Physically Handicapped Children in Elementary Schools, prepared by the Architectural and Transportation Barriers Compliance Board.
- L. NFPA 54 - Fuel Gas Code.
- M. NFPA 58 - Standard for the Storage and Handling of Liquefied Petroleum Gases.
- N. ASME - American Society of Mechanical Engineers.
- O. Other applicable building, safety, or fire codes having jurisdiction over equipment, materials or methods. The decision of the Architect and/or Engineer will be final in event of dispute over code to use or its interpretation.

20.2 ELECTRICAL REQUIREMENTS

- A. The Mechanical Contractor shall furnish to the Electrical Contractor all motor starters as required. Electrical Contractor shall install, provide magnetic starters, reversing starters, multiple speed starters, etc., as required. All poly-phase motors and all motors which are automatically controlled shall be furnished with magnetic starters, full voltage, non-reversing type, complete with necessary auxiliary contracts for controls unless otherwise noted. Heaters shall be of the melting alloy type, sized to the exact nameplate running current of the motor. Overloads shall have visual trip indicators and shall be trip-free with reset button

held in. All magnetic motor starters or controllers shall be equipped with one over-load element in each phase. Manually operated motors with magnetic controllers shall be provided with oil-tight pushbutton stations and automatically controlled motors shall be provided with oil-tight, "hand-off" automatic switches. All magnetic starters shall be provided with red bull's eye pilot light in cover. Energy for controlled circuits shall be taken through auxiliary contacts, and shall not be taken from the load contacts from the starters. All power wiring and control wiring shall be run in rigid conduit in damp locations or electrical metallic tubing in dry locations and shall conform to NEC Standards.

20.3 MOTORS

- A. Unless otherwise specified or required for the particular application, motors shall conform to the following requirements. Refer to specific equipment specifications for special motor voltage, phasing and starting requirements.
- B. Each motor shall have sufficient capacity to start and operate the machine it drives without exceeding the motor nameplate rating at the speed specified or at any speed and load which may exist with the drive actually furnished.
- C. Each motor that is provided with automatic control or under automatic control shall be capable as frequent starts as the control may demand, however, not less than 4 starts per hour for any motor.
- D. All belt connected motors, regardless of size, shall be equipped with shafts and bearings that will withstand both the normal belt pull of the drive furnished and the momentary or continuous overloads due to acceleration or incorrect belt tension.
- E. Motors shall be continuous duty at 100 percent of rated capacity and temperature rise shall be based on 50°C ambient. Motors shall conform to NEMA Standard MG-1 and shall have a 1.5 service factor and be energy efficient type.
- F. Each direct connected motor shall be securely mounted in accurate alignment. Each belt connected motor shall be provided with a securely mounted adjustable base to permit installation and adjustment and alignment of belts.
- G. The insulation resistance between starter and rotor conductors and frames of motors shall be not less than one-half megohm.
- H. No shop test of motors will be required, but the insulation resistance and general operating characteristics shall be determined at start-up and final inspection by the Contractor as directed.

SECTION 15030

MECHANICAL SYSTEMS SCHEDULE

30.1 GENERAL

- A. The work specified herein shall include all labor, materials, equipment, tools, supplies and supervision required to install and place in the mechanical systems and appurtenances specified herein and/or indicated on the drawings or reasonably implied as necessary for completion of the various systems.

30.2 SCOPE OF WORK

- A. Furnish and install a complete sanitary plumbing system as shown on drawings and described herein.
- B. Furnish and install a complete heating and air conditioning system as shown on drawings and described herein.
- C. Furnish and install a complete ventilation system as shown on drawings and described herein.
- D. Furnish and install fire protection system as described herein.
- E. Furnish and install hood and exhaust fans.
- F. Make final connections to Owner furnished equipment furnished by separate contract. This contractor shall be responsible for verifying rough-in requirements and dimensions. Furnish necessary valves and traps, etc. for connections.

30.3 WORK BY OTHERS

- A. The Electrical Contractor shall bring adequate power to and make final connections to all equipment furnished under this Contract. All HVAC and energy management control wiring shall be by Mechanical Contractor. All power and interlock wiring of fire protection and AHU smoke detector/shutdown by Electrical Contractor.
- B. The General Contractor shall do all painting as required; shall furnish all major openings in building structure as required for installation of the mechanical system; shall furnish all door louvers and wall ventilation louvers as required; and shall assist Mechanical Contractor with installation of all equipment in outside walls and on roof. Touch up painting on mechanical equipment by Mechanical Contractor.
- C. All items of labor, materials and equipment not specifically stated herein or on plans to be by others and are required to make the system complete and operative shall be by this Contractor.
- D. Painting - The Mechanical Contractor shall provide skilled craftsmen to prepare, apply, and paint the following:
 - 1) All exposed fire protection piping and accessories shall be primed and painted with two coats of rust inhibitive alkyd paint - red color - approved by Architect. Delete painting on chrome or brass/bronze items.

- 2) Prime and paint all ferrous metal sleeves, supports and hangers exposed in finished areas, on roof, and elsewhere as indicated. No paint is required for zinc plated metal in non-finished areas. Paint shall be rust inhibitive alkyd type, color and approval by Architect.
- 3) Paint all exposed insulated domestic water piping, chilled/heating water piping, and gas piping located in Mechanical Room A132.

Domestic Water Piping - Green

Chilled Water Piping - Blue

Heating Water Piping - Yellow

Gas Piping – Black

SECTION 15100

BASIC MATERIALS AND METHODS

100.1 EXCAVATION, TRENCHING AND BACKFILLING

- A. Excavate trenches for underground pipe lines to required depth and provide a separate trench for each utility sewer, gas and water line except where otherwise noted on drawings. Lay all pipe in open trench unless given permission for tunneling. excavate trenches of sufficient width for proper installation of the work. When the depth of backfill over sewer pipe exceeds ten feet (10'), keep the trench below the level of the pipe as narrow as practicable.
- B. Sheet and brace trenches and remove water as necessary to permit proper installation of the work. Under no circumstances lay pipe in water. Keep the trench free from water until pipe joint material has hardened. The presence of ground water in the soil or the necessity of sheeting or bracing trenches shall not constitute a condition for which any increase may be made in the contract price.
- C. Grade the bottom of trenches evenly and excavate bell holes to insure uniform bearing for the full length of all pipes. Cut holes as necessary for joints and joint making. Excavate all hard material to at least four inches (4") below the pipe at all points. Refill such space and all other cuts below grade with sand or fine gravel firmly compacted.
- D. After pipe lines have been tested, inspected and approved by the Architect or Engineer and prior to backfilling, remove forms and clean excavations of trash and debris to prepare for backfill.
- E. When proper time has elapsed for joint hardening, if necessary, initial backfilling shall be performed by hand, together with tamping until fill has progressed to an elevation at least one foot above the top of pipes. During the initial backfilling, approved granular material (where required) of loose soil free from lumps, clods, frozen material or stones shall be deposited in layers of approximately six inch (6") thickness and compacted by hand or with manually operated machine tampers actuated by compressed air or other suitable means. Trench filling from the point one foot above the top of pipe in unimproved areas (outside limits of buildings, parking areas, driveways, alleys, streets and the like) backfill may be deposited by bulldozer, drag line, or other suitable means in layers with sufficient surplus material neatly rounded over the trench to compensate for after settlement. All surplus excavated materials shall be disposed of by the Contractor at his expense unless otherwise directed by the Architect or engineer. Trench filling from the point one foot above the pipes under improved areas (buildings, driveways, parking areas, streets and the like) here danger from settlement exists. Backfill shall proceed in layers and compacted to the Proctor density as specified in the Architectural specifications governing the project. Compaction tests as specified therein shall be observed a if repeated herein. Backfill and compaction shall be approved by the Architect prior to pouring of concrete, paving, etc.
- F. Excavation and trenching to comply with 29 CFR, 1926 Subpart P, Excavation.

100.2 GENERAL PIPING INSTALLATIONS

- A. Arrange, install piping approximately as indicated straight, plumb, and as direct as possible; form right angles or parallel lines with building walls. Keep pipes close to walls, partitions, ceilings, offset only where necessary to follow walls as directed. Locate groups of pipes

parallel to each other; space them at distance to permit applying full insulation and to permit access for servicing valves.

- B. Install horizontal piping as high as possible without sags or humps. Grade drainage piping or uniform slope of 1/4" per foot minimum; where this is impossible, maintain slope as directed but in no case less than 1/8" per foot.
- C. Locate valves for easy access and operation where concealed; provide access doors of the proper type for the construction into which they are installed. Do not locate any valves with the stems below horizontal.
- D. Provide water supply, drain, and vent connections to equipment specified in other sections requiring such services. Indicated locations and sizes of equipment connections are approximate; exact locations and sizes of piping, valves, shall conform to approved shop drawings and printed installation directions furnished by equipment outlets for same.
- E. Drains and P-traps shall be provided at all coils, and pipe to roof drains. Such drains shall consist of the necessary pipe, valves and fittings required in the opinion of the Architect or Engineer to permit servicing of equipment, systems, etc.

100.3 PIPE SLEEVES

- A. Pipe sleeves schedule 40 zinc coated steel pipe shall be provided for all pipes passing through exterior or rated walls of 1 hour or more, slabs on grade, and all floor pipe penetration and utility trench penetrations. Sleeves may be omitted where pipes pass through exterior walls above ground to lawn faucets, wall hydrants and downspout nozzles.
- B. Sleeves passing through floors, utility trench, interior walls or floors rated one (1) hour or more, and exterior walls which are provided with membrane waterproofing shall be sealed with approved elastomeric fire proofing sealer. Provide an expandable fire caulk and restraining collar for PVC pipe penetrating rated walls, floors, and ceilings. This caulking shall be UL tested, rated and classified according to 1994 Underwriters Laboratories, Inc., Volume II, and shall be approved by Fidelity Mutual and Southern Building Code Conference.
- C. Sleeves pipes passing through potentially wet floors that do not have membrane waterproofing such as in toilet rooms, mechanical rooms, etc., shall be zinc coated steel pipe and shall project one and one-half inches (1-1/2") above the finished floors, and shall be chalked watertight.
- D. Sleeves provided for all pipes passing through floors, utility trench, and exterior walls shall be schedule 40 zinc coated steel. Sleeves inside building through rated walls shall be minimum 26 gage galvanized sheet metal and extend minimum 6" past wall both sides.
- E. Sleeves shall be built into the walls and floors as the work progresses.
- F. Sleeves through exterior walls below grade shall be not less than two inches (2") greater in inside diameter than the outside diameter of the pipe it serves; all other sleeves shall be large enough to provide approximately 1/4-inch clear annular space between the sleeve and pipe or between the sleeve and insulation where insulation is required. Except as hereinbefore specified for wet area floors, sleeves shall be of sufficient length to terminate flush with the finished floor or wall.

- G. Spaces between pipes and sleeves passing through exterior walls, slabs on grade and over crawl spaces, and waterproofed floors shall be chalked watertight. Spaces between pipes and sleeves passing through floors, walls, and ceilings of machine spaces, such as mechanical equipment, refrigeration, boiler, pump, fan, machinery rooms, and rated walls shall be packed and sealed at both ends of sleeve to provide an airtight acoustical barrier with approved fire stop material.

100.4 FLOORS AND CEILING PLATES

- A. Furnish and install chrome-plated type floor and ceiling plates or escutcheons on all exposed pipe passing through floors, walls and ceilings. Inside diameter shall fit around insulation or around pipe; when not insulated, outside diameter shall cover sleeve. Where sleeve extends above finished floor, escutcheon shall clear sleeve extension. Secure escutcheons or plates to pipe or sleeve but not to insulation.

100.5 ROOF FLASHING

- A. Vent pipes passing through roof shall be flashed with four (4) pound lead sheet or 16 oz. copper, at least twenty inches (20") square, and shall be extended up and turned down at least 1" inside pipe, with pipe at least twelve inches (12") above roof at center line. Vents shall off-set in roof joist area or ceiling cavity if necessary so that no vent shall be closer than 4'-0" from outside wall line.

100.6 RECORD DRAWINGS

- A. This Contractor will be given two (2) sets of blue line prints by the Architect. Indicate all variations in running of pipe, location of drains, cleanouts, equipment, etc., from that shown on original drawings in red pencil. These blue line prints shall be turned over to Architect - Engineer upon completion of the job.

100.7 SYSTEMS CLEANING AND TREATMENT

- A. All potable water lines shall be thoroughly flushed and then sterilized with a solution containing not less than 50 ppm available chlorine for eight (8) hours. During sterilization operate all valves, faucets, etc., so that all portions of system are reached. Flush system with clear water until concentration drops to 0.5 ppm. Obtain bacteriological certificate from local health department for water sample and submit with final documents at completion.
- B. Heating and chilled water cleaning.

100.8 FILTER CLEANING

- A. Air handling equipment on this project shall not be operated during any stage of construction, clean-up, or testing without design efficiency filters.
- B. Where operation of equipment is permitted by the Architect for finished painting, plaster curing or the like, disposable filters of design efficiency shall be used and replaced with new filters at time of acceptance. Contractor shall provide new and clean filters at the time of acceptance.

100.9 IDENTIFICATION

- A. All starters, controllers, panels, energy management switches overrides and equipment shall be identified with self-adhesive engraved phenolic markers of an approved type indicating the equipment designation used on the drawings AHU-1, Pump #1, Unit No. 1, etc. A list of markers shall be submitted for approval prior to ordering. Valves shall be identified with brass tags and "S" hooks complete numbers and lists of function of the valve framed glass and posted in the Equipment Room. All labels and coordination by Mechanical Contractor.

- B. Pipe lines accessible for maintenance (except piping in finished spaces) shall be identified as to service with Seton, Set Mark semi-rigid plastic identification markers. Direction of flow arrow shall be included on each marker. Color coded background shall be in accordance with ANSI A13.1-1975 "Scheme for the Identification of Piping Systems". Locations shall be as follows:
 - 1) Adjacent to each valve and fitting (except plumbing fixtures).
 - 2) At each branch and riser take-off.
 - 3) At each pipe passage through wall, floor and ceiling construction.
 - 4) At each pipe passage to underground.
 - 5) On horizontal runs - marked every 25 feet.

- C. Size and color coding of phenolic labels shall be as follows:
 - 1) Starters shall be labeled red with white background, 1/2" tall lettering.
 - 2) Disconnect switch shall be labeled black with white background, 1/2" tall lettering.
 - 3) Energy management master panel(s) shall be labeled green with white background, 3/4" tall lettering. Each master, slave, and override panel shall be appropriately labeled and identified as to "Master Panel", "Override Panel", etc.
 - 4) Individual fan coil and equipment override switches, either in the master or slave panels, or individual floor fan coil unit override panels shall be labeled with maroon with white background, 1/4" tall lettering. Chiller, pump, fan, rooftop unit, etc. override/manual switches shall be marked with equipment designation and position options. Individual floor fan coil unit zone override switches shall be labeled as to zone served, i.e., "Zone 1 - Southwest", etc.

100.10 TESTS

- A. This Contractor shall conduct such tests as required to determine that systems and equipment which he installs conforms to specifications. Contractor shall supply all labor, materials, instruments, operations, etc., required to facilitate testing. Gages, thermometers, and instruments used in testing shall be accurate, recently calibrated and approved by the Engineer prior to test. Instruments installed permanently in systems, as specified hereinbefore, may be used in testing when approved by the Engineer. Tests shall be as follows:
 - 1) Water Piping - Domestic Systems: 100 PSI hydrostatic, with no discernable pressure loss for period of eight (8) hours.

- 2) Chilled & Heating Water Piping: 100 PSI hydrostatic, with no discernable pressure loss for a period of eight (8) hours.
- 3) Sanitary: Minimum ten feet (10') hydrostatic test and as required by ASA-A40.8 or local code.
- 4) Relief Valves: Fire equipment until safety valves relieve. Record temperature and/or pressure at time of opening.
- 5) Thermometers, Gauges, Etc.: Contractor shall remove, recalibrates and/or replace any instrument installed in the system as directed by the Engineer when accuracy is questionable, mercury columns are separated or other such conditions exist.
- 6) Gas Piping: All gas piping shall be tested at twice the operating pressure or 150 PSI which is greater with compressed air or nitrogen for a period of not less than eight (8) hours.

100.11 TESTING AND ADJUSTING OF EQUIPMENT

- A. Upon completion of the various systems, this Contractor shall set and adjust all valves, dampers, controllers, thermostats, etc.
- B. Each and every phase of the air conditioning, heating and ventilating system shall be operated for a sufficient period of time to demonstrate to the entire satisfaction of the Architect and/or Engineer, the ability of the system to meet the capacity and performance requirements.

100.12 PROTECTIVE DEVICES

- A. All couplings, motor shafts, gears, belt drives, or other rotative or moving parts shall be fully guarded, in accordance with ANSI B15.1 Safety Code for Mechanical Power Transmission Apparatus. Guards shall be steel and expanded metal or sheet metal as approved. Guards shall be rigid, suitably secured and readily removable for maintenance without disassembly of the guarded unit.

100.13 GUARANTEE

- A. This Contractor shall guarantee that this system when turned over to the Owner has been installed in accordance with the Contract Documents. He shall also guarantee to keep all work embraced in these Contract Documents in repair and proper working order, without charge, for a period of one (1) year from date of Owner's acceptance of the work, except from damage by conditions beyond his control.

SECTION 15110

PIPE AND FITTINGS

110.1 INSTALLATION

- A. All piping installed on this project shall be new and of full weight and size shown and of proper specification for service intended. ONLY PIPE AND FITTINGS MANUFACTURED IN THE UNITED STATES WILL BE ACCEPTABLE. MILL TEST REPORTS AND MANUFACTURER'S CERTIFICATION SHALL BE SUBMITTED TO ARCHITECT AND/OR ENGINEER ON ALL SUCH MATERIALS USED. When piping is cut, it shall be reamed with pipe reamer and all burrs, scale, trash and foreign matter removed. All piping shall be stored off the floor or ground so as to prevent its collecting dirt, plaster, dust, etc. WHERE NON-FERROUS PIPING CONNECTS TO FERROUS PIPING, INSTALL EPCO DIELECTRIC COUPLINGS.
- B. Where piping is threaded dies shall be clean and sharp and joint compound shall be applied to male end only. All joints shall be made up tight; the caulking of these joints will not be tolerated. Pipe joint compound must be approved by the Engineer. Copper tubing may be cut with a tubing cutter or hacksaw with guide. Copper tubing to be thoroughly reamed, cleaned with steel wool or emery cloth and non-corrosive flux before soldering. No solder less than grade specified for service shall be used. Where not specified otherwise, 95/5 shall be used and rolls shall be clearly stamped by the manufacturer as to grade. No other grade solder allowed on the job. NO SOLDER FLUX WITH SOLDER BASE WILL BE ALLOWED.
- C. Where welding is specified or approved, it shall be by electric arc by mechanics skilled in operation and holding a test certificate acceptable to the Engineer. All scale and flux shall be removed from piping after welding. No job made fittings will be acceptable but Weldolets or Thredolets two (2) pipe sizes smaller than main will be allowed up to 4" maximum branch size. Where openings are cut in lines for any purpose, no pump or other operating machine shall be connected to the piping prior to its being thoroughly flushed in presence of the Engineer. On welded line use flanged valves, strainers and specialties, weld neck flanges, and properly rated slip-on flanges.
- D. The Contractor shall submit three copies of his qualified welding procedures to the Engineer for approval. Fabrication shall not begin prior to approval. Qualifications for welding shall be in accordance with the latest editions and addenda of ASME Boiler and Pressure Vessel Code, Section IX, Welding Procedure Qualifications, Article II and American National Standard Code for Chemical Plant and Petroleum Refinery Piping, ANSI B31.3, Chapter V, per the following excerpts:
- Para. 327.5
Para. 327.6
- E. Any mechanic found installing piping without its being reamed, cleaned, deburred, etc., or in any way contrary to above, shall be sufficient reason for all erected piping to be removed, inspected by Engineer, corrected and re-erected, all at Contractor's expense.

110.2 MATERIALS

- A. Pipe for the various services specified shall be as follows:

- 1) Chilled and heating water piping above slab on grade shall be Type "L" copper with brazed or solder joint fittings for 2" diameter and smaller. Butt weld Schedule 40 black steel pipe and weld fittings for 2-1/2" and larger.
- 2) Soil, Waste and Vent Piping: Service weight cast iron with neoprene gaskets or Schedule 40 PVC below floor slab. Above the slab to be no hub cast iron. All piping located in the Kitchen and Boiler Room shall be cast iron.
- 3) All domestic hot, recirculating, and cold water piping inside of building shall be copper tubing, Type "L" conforming to ASTM B88 with brazed or solder joint fittings, copper, brass, or bronze, conforming to ANSI B16.18 or B 16.22. Solder shall be 95/5 or as approved, no solder base flux shall be permitted. Below slab on grade shall be Type "K" with no joints.
- 4) Underground chilled water piping shall be equal to Thermacor Process, Inc. Systems Chill-Therm pressure pipe with ring-tite joints. Core pipe ASTM D2241/SDR26. Joints shall be of "rubber sealing ring in groove of bell end" pipe. Casing shall be PVC (ASTM D1784). Insulation shall be polyurethane closed cell foam completely encapsulated on each end by heat resistant compressed rubber end seal. Fitting shall be ductile iron or cast iron. Provide concrete thrust blocks at each change of direction in piping.
- 5) Utility and relief drains, including AHU condensate drain, shall be PVC Schedule 40 with solvent welded bell joints.
- 6) Gas piping above ground shall be seamless or welded Schedule 40 steel conforming to ASTM A120 or ASTM A53. Fittings shall be malleable iron 150-pound conforming to ANSI B16.9. Underground gas piping shall be steel welded or seamless ASTM A120 or ASTM A53 factory coated and wrapped for resistance to erosion and corrosion. After each joint is welded or joints are made, field coating and wrapping with similar materials shall be made and lines tested for leaks. Underground valves shall be lubricated plug type installed in valve box marked "Gas".
- 7) Sanitary waste outside of Building. Piping shall be Schedule 40 PVC.
- 8) Water lines outside of building shall be PVC Class C-900 with fluid-tite integral bell and gasket. Provide thrust blocks at each change or direction.
- 9) Storm Water Piping: Schedule 40 PVC with solvent welded joints.
- 10) Condensate drain piping to be Type "L" copper tubing with solder joint fittings.

SECTION 15120

VALVES

120.1 GENERAL

A. Valves and strainers shall be furnished and installed as shown on the drawings and as specified herein; where required for service; and shall be as per the following schedule. Valves by other reputable manufacturers which are equal to valves scheduled will be acceptable. Valves 2" and smaller with threaded connections, larger valves with flanged ends, ball and gate valves shall be bronze full port design with handle neck extension for insulation application.

B. Valves for steel piping systems:

<u>Type</u>	<u>2" & Smaller</u>	<u>Pressure Class SWP</u>	<u>Applicable Service</u>
Gate	Nibco T-124	125 lb.	Shutoff for plumbing services.
Globe	Nibco T-211-Y	135 lb.	Bypasses, etc.
Check	Nibco T-413-Y		Flow check, all services.
Ball	Metraflex IT	150 lb.	Balancing and shut-off HVAC service.
<u>2-1/2" & larger</u>			
Butterfly	Stockham LD-711552B	150 lb.	Throttling, balancing chilled water.
Gate	Nibco F619 or T-619	125 lb.	Shutoff all services.
Globe	Nibco F-718-B or T-718-B	125 lb.	Bypasses, etc.
Check	Nibco F-918-B or T-918-B		Flow check, all services.

C. Valves for copper piping systems:

<u>Type</u>	<u>3" & Smaller</u>	<u>Pressure Class WOG</u>	<u>Applicable Service</u>
Gate	Nibco S-124	200 lb.	Shutoff, Domestic Water.
Globe	Nibco S-211-Y	200 lb.	Throttling, Domestic Water.
Check	Nibco S-413-Y	200 lb.	Non-Return, Domestic Water.

Strainers Muessco #351 300 lb. Domestic Water, .057
perforations.

Balancing valves shall be Bell and Gossett "Circuit-Setter" or as approved by Taco or Gerand. Provide to Engineer as a part of this contract, a field test kit equal to Bell and Gossett Model RO-4. Kit to include portable readout meter for field calibration of balancing valves. Provide to Engineer 60 days after award of contract.

SECTION 15130

PIPING SPECIALTIES

130.1 THERMOMETERS

- A. Thermometers shall be of the industrial mercury type with 9" adjustable angle cast aluminum case and brass stem with baked bronze finish and brass separable extension sockets. The proper range shall be selected so that the operating temperature of the material measured will fall approximately in the middle of the scale. Units equal to Terice #A405.

130.2 MISCELLANEOUS

- A. Furnish and install pressure gauges in pipe lines where shown on the drawings. Gauges shall be Terice or equal, #800 strength, clear glass window, 3 1/2" dial with black figures and graduations, black pointer, brass movement, trumpet brass, Burdon tube, brass bottom connected socket 1/3" N.P.T. Accuracy shall be 1-1/2". Dial range and graduations shall be appropriate to the system with indication in the middle 1/3 of the range. Each pump gauge inlet shall be mounted with a Series 870 impulse damper and #865 "T" cock. Gauges on steam lines shall be mounted with #885 coil syphon and #865 "T" handle cock.
- B. Furnish and install air vents, where indicated, and at all other locations in supply and return mains where rises and drops may occur, and at the tops of all supply and return risers, as full size 6" high capped pipe air chamber (maximum size 4"). Connect a 1/8" copper tube and run the tube to an accessible location and install a T handle manual pet cock for draining in a bucket.
- C. Furnish and install balance valves at each location indicated on drawings. The balance valves shall be bronze with brass ball and with glass and carbon-filled TFE seat rings. Valves shall be equipped with differential pressure read-out ports across valve seat area. Read-out ports to be fitted with integral EPT check valves, valve body to have 1/4" NPT drain/purge port. Valves to have memory stop feature to allow valves to be closed for service and then reopened to set point without disturbing balance position, and calibrated name plates to assure specific valve settings. Valves shall be supplied with molded preformed insulation, suitable for use on heating or cooling systems, to permit access for balance and read-out. Balance valves to be leak tight at full rated working pressure of 300 psig at 250°F. Balance valves to be Bell & Gossett Model "CB" circuit setters or approved equal with threaded connections.
- D. Water flow measuring devices:
 - 1) Minimum overall accuracy plus or minus two percent over a range of 70 to 110 percent of design flow. Select devices for not less than 110 percent of design flow rates. Install water flow measuring devices per manufacturer instructions.
 - 2) Venturi type: Bronze, cast steel, or cast iron with bronze throat, with valved pressure sensing taps upstream and at the throat. Equal to Gerand style VW-F.
 - 3) Pitot Tube type: Brass or stainless steel pressure averaging metering tube, shutoff valves and quick-coupling pressure connections. Metering tube shall be rotatable so all sensing ports may be pointed down-stream when unit is not in use. Equal to

- Taco Sentinel or Annubar Models AWR 73 and AWR 75.
- 4) Permanently mounted water flow indicating meters for base mounted pumps: Shall have minimum 125 psig working pressure with #5% accuracy and shall be sized for 120 percent of design flow rate. Minimum 10" long scale to read directly in GPM, device to be push-to-read type or valve operated. Equal to Metraflex, Armstrong, or Bell and Gossett Thermoflow.

130.3 AIR CONTROL

- A. Air Separator: Furnish and install as shown on plans an air separator for GPM shown on plans. The air separator shall have flanged tangential nozzles, stainless steel air collector tube without strainer. The air separator shall be fitted with and appropriate NPT vent connection to facilitate installation of piping to connect a compression tank to the air separator. An appropriate NPT connection shall be provided on the bottom of the air separator to facilitate periodic blowdown. The air separator must be designed, constructed and stamped for a maximum working pressure of 125 PSI @ 350°F. in accordance with SEction VIII, Division I of the ASME Boiler and Pressure Vessel Code, and registered with the National Board of Boiler and Pressure Vessel Inspectors. The air separator shall be painted with one coat of air dry enamel.

A Manufacturer's Data Report for Pressure Vessels, Form U-1 as required by the provisions of the ASME Boiler and Pressure Vessel Code shall be furnished for each air separator upon request.

Each air separator shall be equal to Armstrong Air Separator.

- B. Tank Fitting: Furnish and install as shown on plans, a cast iron compression tank fitting designed to establish the correct initial air to water ratio in the compression tank when filling the system. The tank fitting must have an air separating trap to assure the migration of free air from the boiler to the compression tank during the heating cycle. The tank fitting must also have an integral liquid level control baffle to prevent gravity backflow of air absorbing cooler water from the compression tank to the boiler during the cooling down cycle. The tank fitting must include a manual vent to facilitate adjusting air volume in the tank. The tank fitting must be designed for a maximum working pressure of 125 PSI @ 250°F. The tank fitting shall be painted with one coat of air dry enamel paint.

Each tank fitting shall be equal to Armstrong Tank Fitting.

- C. Compression Tank: Furnish and install as shown on plans, vertical compression tank with two 1/2" NPT gauge glass tapings in one head and a minimum of two 1" NPT tapings in the shell. The tank must be designed, constructed and stamped for 125 psig @ 375°F. in accordance with Section VIII, Division I of the ASME Boiler and Pressure Vessel Code, and registered with The National Board of Boiler and Pressure Vessel Inspectors. The compression tank shall be painted with one coat of air dry enamel.

A Manufacturer's Data Report for Pressure Vessels, Form U-1 as required by the provisions of the ASME Boiler and Pressure Vessel Code shall be furnished for each compression tank upon request.

Each compression tank shall be equal to Armstrong. See plans for sizes.

- D. Automatic air vent: High capacity type rated for 150 psig, cast iron casing with stainless

- steel, brass, Buna-N and silicone rubber interval components. Armstrong or as approved.
- E. Furnish and install as shown on plans, a straight pattern valve designed to perform the functions of a non-slam check valve, throttling valve, shut off valve, calibrated balancing valve and system flowmeter.

The valve shall be of heavy-duty cast iron construction with standard 125 psig ANSI flanged connections, and rated for a maximum working pressure of 175 psig at 250°F. The valve shall be fitted with a EPDM (soft seat) seat, replaceable bronze disc, stainless steel stem and chatter-preventing spring. The valve design shall permit repacking under full system pressure.

Each valve shall be equipped with brass readout valves (with integral check valve) for taking differential pressure readings across the orifice to accurately balance the system to specified design conditions.

All valves shall be equal to Armstrong (Straight Pattern) Triple Duty Valve.

130.4 HVAC MAKE-UP WATER SYSTEM

- A. Water pressure reducing valve and connections: Single-seated, for dead end service for 30 to 125 pounds range on low pressure side. Cast iron or semi-steel body with brass or bronze trimmings, flanged connections, composition diaphragm, and bronze springs.

Operation: Diaphragm and spring to act directly on valve stem. Delivered pressure shall vary not more than one pound for each ten (10) pounds variation on inlet pressure.

- B. Pressure relief valve: Bronze or iron body and bronze or stainless steel trim, with testing lever. Comply with ASME Code for Pressure Vessels, Section VIII, bear ASME stamp.
- C. Reduced pressure backflow preventor: Provide with air gap drain assembly. Equal to Watts or Febco.

130.5 POT FEEDER/FILTER

- A. Pot Feeder/Filter: By-pass type for chemical treatment schedule 10 gauge heads, 3/4 inch system connections and large neck opening for chemical addition. Feeders shall be five gallon minimum size for hot water and chilled water systems. Feeder shall have removable cleanable filters.

SECTION 15140

MECHANICAL DEVICES

140.1 PIPE HANGERS

A. General:

Pipe hangers and supports shall be Fee & Mason, Grinnell, Elcen or approved equal, similar and equal to Fee & Mason figure numbers shown.

B. Steel Pipe:

1) All horizontal steel pipes to be supported as below:

Up to 2"	3/8" rod	7' spacing
2-1/2" - 3"	1/2" rod	10' spacing
4"	5/8" rod	12' spacing

2) Hangers and supports for steel pipe shall be as below:

Exposed Piping - 1/2" to 4"		F & M Fig. 400 Zinc Plated
Exposed Riser Clamps - 1/2" to 4"		F & M Fig. 241 Zinc Plated
Concealed or Insulated -1/2" to 2"		F & M Fig. 199 Black
	-2-1/2" to 4"	F & M Fig. 239 Black
Riser Clamp -1-1/2" to 4"		F & M Fig. 241 Black

C. Copper Pipe:

1) All copper pipe to be supported as below:

Up to 3/4"	3/8"rod	5' spacing
1" to 2"	3/8"rod	7' spacing
2-1/2" to 4"	1/2"rod	10' spacing

2) Hangers and supports for copper pipe shall be as below:

Up to 4" Fee & Mason Figure 500 Copper Plated. 5" & larger Fee & Mason Figure 364 Copper Plated.

Riser clamps for copper pipes shall be Fee & Mason Figure 368 Copper Plated.

D. Beam Attachments: For pipe 2" or smaller, beam attachments shall be Fee & Mason Fig. 255L "C" clamp with lock nut for pipe sizes larger than 2", Fee & Mason Figure 246 beam clamp shall be used.

E. Threaded Rod:

- 1) All threaded rods will correspond with type of hanger used.
- 2) The load on the hangers shall be the determining factor and the maximum recommended hanger rod load, as catalog listed, shall govern as below:

Rod Diameter 3/8"	Maximum Load 610
Rod Diameter 1/2"	Maximum Load 1130
Rod Diameter 5/8"	Maximum Load 1810

The above hanger rod loading is based on threaded hot rolled steel conforming to ASTM-A-107.

- 3) All threaded rod shall be Fee & Mason Figure 263 galvanized.

140.2 FOUNDATIONS AND EQUIPMENT SUPPORTS

A. This contractor shall provide suitable foundations, supports, stands, suspended platforms for machinery, tanks, and other equipment as indicated on drawings, specified herein or as required to make a neat, substantial and workmanlike job. All foundations, supports, stands, etc., shall be approved by the Architect/Engineer prior to construction. Provide 4" thick reinforced pad for all floor mounted mechanical equipment

140.3 VIBRATION AND NOISE CONTROL

- A. All rotating equipment shall be isolated from connecting piping, ductwork, structure or other rigid utilities, etc. by means of the appropriate vibration isolation. The CONTRACTOR shall provide and install the appropriate vibration isolation on any equipment, with moving parts.
- B. No metal-to-metal contact will be permitted between fixed and floating parts.
- C. Connections to equipment: Allow for deflections equal to or greater than equipment deflections. Electrical, drain, piping connections, and other items made to rotating or reciprocating equipment (pumps, compressors, etc.) which rests on vibration isolators, shall be isolated from building structure for first two hangers or supports.
- D. Common foundation: Mount each electric motor on same foundation as driven machine. Hold driving motor and drive machine in positive rigid alignment with provision for adjusting motor alignment and belt tension. Bases shall be level throughout length and width. Provide shims to facilitate pipe connections, leveling, and bolting.
- E. Provide heat shields where elastomers are subject to high temperatures.
- F. Extend concrete bases for pipe elbow supports at suction connections at base mounted pumps. Pipe elbow supports shall not short circuit pump vibration to structure.

- G. Inspection and adjustment: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace isolators as required to reduce vibration and noise transmissions to acceptable levels as required by the Engineer.
- H. Elastomeric isolators shall comply with ASTM D2240 and be oil resistant neoprene with a maximum stiffness of 60 durometer and have a straight-line deflection curve.
- I. Uniform loading: Select and locate isolators to produce uniform loading and deflection even when equipment weight is not evenly distributed.
- J. Minimum static deflection of each vibration isolator unit shall be as recommended by unit manufacturer or as required for each specific piece of equipment by vibration isolator manufacturer to ensure acceptable vibration/noise isolation.

140.4 EQUIPMENT MOUNTING

- A. No equipment unit shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators and such direct support is approved by the equipment manufacturer. All support frames shall be sufficiently stiff and rigid so as to prevent distortion and misalignment of components installed thereon.
- B. Unless otherwise indicated, all equipment mounted on vibration isolated bases shall have a minimum operating clearance of two (2) inches between the equipment and the concrete housekeeping pad or floor beneath the equipment. The clearance space shall be checked by the CONTRACTOR to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.
- C. All wiring and other connections to vibration isolated units shall be made flexible in order to avoid short circuiting the isolators. A minimum four (4) foot length of armored flexible conduit or cable installed in the shape of a U is acceptable for electrical connections. In the case of large diameter conduits, a sheet metal duct with flexible connection may be used for conduit connections to vibrating equipment. Flexible material shall be the same as that described for ducts connecting to fans.
- D. Under no conditions shall piping, ductwork or conduit be suspended from one another or physically contact one another. Vibrating systems shall be kept free from non-vibrating systems.
- E. Vibration isolation hangers shall be positioned so that hanger housings may rotate a full 360 degrees without contacting any object.

140.5 PIPING FLEXIBLE CONNECTIONS

- A. Spherical Connector: Single-sphere or twin-sphere, precision molded of multiple layers of nylon cord and neoprene rated 175 psi working pressure at 250 degrees F. (Metraflex or as approved).
 - 1) 2 inch and larger: Provide steel or ductile iron independent (floating) flanges. Furnish manufacturer's tie rod assembly.
 - 2) 1-1/2 inch and smaller: Threaded union end connections. Utilize flexible connector for service intended and as recommended by manufacturer.

140.6 PIPE SUSPENSION ISOLATION

- A. All pipe runs 2" or larger connected to rotating equipment in mechanical room shall be mounted on steel spring and/or elastometer isolators. Unless otherwise specified, the minimum deflection of the isolator shall be 3/8 inch. Utilize type 2 spring hangers or suspended piping and type 2 spring isolators on their mountings. Install piping vibration isolators a minimum distance of 8 feet horizontally away from rotating or reciprocating mechanical equipment.
- B. Pipes connected to vibration isolated assemblies shall in no way strain or force out of alignment the vibration isolators supporting the assembly nor shall pipes restrict a unit from "floating" freely on its isolators.
- C. Pipe elbows at inlets or discharges of floor mounted pumps which require support from below shall be braced to the unit base above the vibration isolators. All inlet and discharge piping, including associated heat exchangers, expansion tanks, strainers, valves, etc., shall be isolated by hangers having the same deflection characteristics.
- D. Ceiling suspended piping in Mechanical Equipment Room shall be isolated or alignment isolators as required to achieve the specified deflection. The minimum static deflection of the steel spring element of all isolators within a distance of at least 50 feet along a pipe in either direction from the equipment isolated shall be 1 inch.

SECTION 15160

MECHANICAL SYSTEMS INSULATION

160.1 GENERAL

- A. Insulation shall include all insulating materials, their applications, bands, tiewire, and weather protection for all pipe, fittings, valves, and equipment as indicated and as specified herein.
- B. Pipe insulation shall pass full thickness through hanger with galvanized sheet metal saddle at each hanger as per schedule below:

Through 3"	16 ga. x 12"
3 1/2 thru 6"	14 ga. x 16"
- C. Insulation shall be applied by an approved Insulating Contractor employing trained insulating personnel.
- D. No insulation shall be applied over pipes, fittings, or other surfaces which are not clean. Insulation shall be applied after pipes have been thoroughly tested and proven tight by the Mechanical Contractor.
- E. Insulation on piping passing through walls shall pass through the wall with full thickness insulations. Sleeves shall be sized to allow full insulation.

160.2 INSULATE PIPING MATERIALS AS FOLLOWS

- A. Domestic hot and cold water and horizontal storm water piping shall be insulated with 3/4" thick John-Manville "Micro-Lok AP-T" fiberglass pipe insulation or approved equal. Longitudinal laps and butt strips shall be smoothly secured with Benjamin-Foster 85-20 adhesive. Fittings and valves on pipe sizes smaller than 3" shall be insulated with J-H #301 insulating and finishing cement to a thickness equal to the adjacent pipe insulation. Fittings and valves 3" and larger shall be insulated with molded Fiber Glass covers secured with Fab-Cloth and finished with a generous coat of Foster 31-99 Mastic. The underside of all roof drains shall be insulated with 2" fiberglass duct wrap insulation with all joints and seams glued and sealed.
- B. Condensate drains shall be insulated with 1/2" Armstrong "Armaflex" and seal all joints with 520 cement.
- C. Chilled and heating water supply and return piping inside building shall be insulated with one inch (1") thick Trymer 2000XP Phenolic insulation. Insulation on piping outside building shall be one inch (1-1/2") thick urethane with water proof jacket. Paint jacket with white paint. All insulated chilled water piping exposed to the weather shall be additionally finished with .016" corrugated aluminum jacket, all joints overlapped a minimum of 2", secured with 1/2" aluminum strappings and seals at 12" o.c. Coordinate installation of heat tape on exterior exposed piping at chiller. All fittings, tees and elbows shall be insulated with premold insulation covers of the same insulation specified for piping. Provide lapping section of fab-cloth and two generous coats of vapor sealer. Exterior valves and fittings shall be also covered with premolded aluminum covers.

- D. Interior located valve bodies, unions, expansion compensators, expansion tanks, air separators, flanged joints, strainers, etc. shall be insulated with job fabricated sections of unicellular insulation. Sections of adjacent pipe insulation shall be terminated close to fitting, valve, etc. and vapor sealed. Unicellular type insulation, nominal 3/8" thick for piping appurtenance 2" or less, and 1/2" thick for larger sizes shall then be cut, formed and fitted and shall overlap adjacent insulation a minimum one inch. Overlapped section shall be fitted and sealed with adhesive. For valves, use nesting size sections of insulation. Secure all insulation with adhesive. Exposed piping, valves, and appurtenances insulated with unicellular insulation in finished areas and equipment rooms, where pipes are specified to be painted, shall be coated with white sealer recommended by flexible unicellular insulation manufacturer prior to final coat. The pump impellor housing of chilled water pumps shall be neatly insulated with 1/2" unicellular type insulation.

SECTION 15200

DOMESTIC WATER SYSTEM

200.1 PIPING SYSTEMS

- A. Domestic water piping shall be as per Sections 15100 and 15110.
- B. Domestic piping systems shall be insulated as per Section 15160.
- C. All water supply piping, fittings and fixtures shall be protected against water hammer shock or surge pressure by mechanical pneumatic air chamber, Josam, Wade, Smith, Zurn or approved equal, sized in accordance with current PDI Standards.

Smith Fig. No.	P.D.I. Symbol	Fixture Unit Rating	Size
5005	A	1 - 11	3/4
5010	B	12 - 32	1
5020	C	33 - 60	1
5030	D	61 - 113	1
5040	E	114 - 154	1
5050	F	155 - 330	1

SECTION 15250

SOIL AND WASTE SYSTEMS

250.1 PIPING

- A. All soil, waste and vent piping shall be as per Section 15100 and Section 15110.
- B. Furnish all cleanouts and/or test tees as shown on plans and at foot of each soil, waste and drain stack. Cleanouts shall be same size as the pipe they serve except that four inches (4") shall be maximum size required. Horizontal lines shall be provided with cleanouts at end of each run, change in direction, and mains not to exceed fifty feet (50') apart.
- C. Cleanouts shall be manufactured by Smith, Wade, Zurn, Josam or approved equal to Smith units specified below:
 - 1) Vertical and horizontal lines exposed - Test Tee - Smith 4510.
 - 2) Vertical lines concealed - Smith 4472 with stainless steel access cover.
 - 3) Horizontal lines under unfinished floors - Smith 4405.
 - 4) Finished Floors - Smith 4023 cast iron adjustable floor level cleanout assembly with round polished bronze top. Provide carpet clamping type for carpet applications.
 - 5) Finished Floors - Linoleum, Terrazzo or Tile - Smith 4143 cast iron adjustable floor level cleanout assembly with round polished bronze top. Top depression to be covered with surrounding floor pattern bonded with waterproof adhesive.
 - 6) All lines outside of building - Smith 4400.
 - 7) Wall cleanouts in finished areas - Smith 4434.

All cleanouts located outside of building shall extend up to the finish grade and shall be held in place by a poured concrete block eighteen inches (18") square and four inches (4") thick.

SECTION 15300

PLUMBING FIXTURES, TRIM AND SPECIALTIES

300.1 FIXTURE SUPPORTS

- A. All fixtures must be securely fastened to the floor or walls by means of inserts or expansion bolts in concrete work, and by means of expansion bolts, toggle bolts or through bolts in masonry work, and by means of framing and screws in frame construction, to the satisfaction of the Contracting Officer.
- B. Wall hung lavatories, urinals and other wall hung fixtures where scheduled on drawings are to be supported by Josam, Wade, or approved equal chair carriers with integral adjustable fittings.

300.2 PLUMBING FIXTURE AND TRIM

- A. Furnish and install all plumbing fixtures and equipment as scheduled and shown on drawings. All plumbing fixture brass trim shall be so designed that all wearing parts are to be in a standardized renewable operating unit which can be removed without detaching the supply fixture or faucet proper. The standardized renewable operating units are to be interchangeable with all supply fixtures and faucets. All exposed metal parts of all fixtures, including faucets, waste fittings, waste plugs, strainers, flush valves, traps, supplies, nipples and escutcheons shall be chromium plated brass, unless other materials or finish is specified. Angle stops with S.P.S. brass nipples from wall to stops shall be provided on all water supplies to fixtures. Fixture trim must be that of the fixture manufacturer wherever possible and must bear a permanent impression of the manufacturer. No "competitive grade" trim will be permitted.
- B. Furnish and install all plumbing fixtures specified herein and shown on Plans. Fixtures to be as follows or pre-approved equal.

WC-1 (Water Closet): Kohler Welcome Lite (K4350) vitreous china, siphon jet, elongated closet bowl with 2-1/4 inch passageway, 1-1/2 inch top spud, bolt covers, Zurn (Z6000AV) flush valve, and Beneke (523-CH-SS) open front, elongated seat with stainless steel hinges and posts.

WC-2 (Water Closet): (Handicap) Kohler Highcliff Waterguard (K-4368) vitreous china, siphon jet, elongated closet bowl with 1-1/2 inch top spud, Zurn (Z6000AV) flush valve and Beneke (523-CH-SS) open front, elongated seat with stainless steel hinges and posts.

L-1 (Lavatory): Kohler Pennington (K-2196-4) 20-1/4" x 17-1/2" self-rimming vitreous china with Zurn (Z6915-CWB) hard wire sensor faucet, 1-1/4 inch offset drain assembly, with open strainer grid drain, 3/8 inch supplies with stop. 1-1/4 inch adjustable trap. Provide Tru-Bro under lavatory trap cover.

L-2 (ADA Compliant Lavatory): Kohler Pennington (K-2196-4) 20-1/4" x 17-1/2" self-rimming vitreous china with Zurn (Z6915-CWB) hard wire sensor faucet, 1-1/4 inch offset drain assembly, with open strainer grid drain, 3/8 inch supplies with stop. 1-1/4 inch adjustable trap. Provide Tru-Bro under lavatory trap cover.

L-3 (ADA Compliant Lavatory): Kohler Greenwich (K-2301) 20"x18" wall hung vitreous china with Zurn (Z6915-CWB) hard wire sensor faucet, Kohler (K-13885) 1-1/4" offset drain assembly with open strainer, K-7608, 3/8 inch supplies with stop. K-8998, 1-1/4 inch adjustable trap. Zurn Model Z-1231 carrier. Provide Truebro Model 102 Insulation Kit.

U-1 (Urinal): Kohler Stanwell (K4972T) vitreous china, wall hung, blow out urinal with jet, integral flushing rim, integral trap, wall hangers and Zurn (Z6003PL-ULF) manual flush valve 1/8 GPF flow, Zurn Model Z-1222 floor carrier. Mount at standard height.

U-2 (ADA Compliant Urinal): Kohler Stanwell (K4972T) vitreous china, wall hung, blow out urinal with jet, integral flushing rim, integral trap, wall hangers and Zurn (Z6003PL-ULF) manual flush valve 1/8 GPF flow, Zurn Model Z-1222 floor carrier. Mount at handicap height.

S-1 (Sink): Elkay Lustertone (LRAD-3322) 33" x 22"x6" double compartment stainless steel sink with raised faucet deck, self-rimming, undercoated, 4-hole, D-1125 duo strainer with removable basket and neoprene stopper, Zurn (Z871B4-HS) faucet 0.5gpm flow with spray hose, aerator, tailpieces, continuous waste, 1-1/2 inch cast brass "P" trap and 3/8 inch wall supplies with wheel handle stop.

S-2 (Sink): Elkay Lustertone (LRAD-1720) 17" x 20"x6" single compartment stainless steel sink with raised faucet deck, self-rimming, undercoated, 3-hole, strainer with removable basket and neoprene stopper, Elkay (LKD2442) faucet, aerator, tailpieces, continuous waste, 1-1/2 inch cast brass "P" trap and 3/8 inch wall supplies with wheel handle stop.

SS-1 (Service Sink): Stern-Williams (HL-2100) 36"x24"x12" molded basin, V-70 bumper guard, 3 inch drain, T-10-VB sink fitting with integral stops, vacuum breaker, T-35 hose and wall bracket and T-40 stainless steel mop hanger.

EDF-1 (Electric Drinking Fountain): Elkay Barrier-Free (EZS-8) 7.6 gallon capacity, one piece backsplash, wall hanger, 1-12 inch cast brass "P" trap and 3/8 inch I.P.S. wall supply with wheel stop. Zurn Z-1225 cooler support.

EDF-2 (Electric Drinking Fountain): Elkay Barrier-Free (EZS-8) 7.6 gallon capacity, one piece backsplash, wall hanger, 1-12 inch cast brass "P" trap and 3/8 inch I.P.S. wall supply with wheel stop. Zurn Z-1225 cooler support. Mount at handicap height.

FD-1 (Floor Drain): Zurn (ZN-415-TP) nickel bronze, trap primer connection and trap primer.

FD-2 (Floor Drain): Zurn (ZN-415) nickel bronze, 8" strainer.

HB-1 (Freeze Proof Hose Bibb): Woodford Model B65 wall hydrant box. Box shall be a flush, fully enclosed type with hinged cover, non-freeze type with vacuum breaker and legend "W" cast on cover.

HB-2 (Hose Bibb): Woodford Model 84 wall hydrant with anti-siphon vacuum breaker, brass body, and tee kee.

RD-1 (Roof Drain): Zurn (ZC-100-C) 15" cast iron body with cast iron grate dome, underdeck clamp, 4" outlet.

RD-2 (Roof Drain): Zurn (ZC-100-C) 15" cast iron body with cast iron grate dome, underdeck clamp, 6" outlet.

ORD-1 (Overflow Roof Drain): Zurn (ZC-100-C-W2) 15" cast iron body with cast iron grate dome, underdeck clamp, 4" outlet. Provide 2" internal water dam.

ORD-2 (Overflow Roof Drain): Zurn (ZC-100-C-W2) 15" cast iron body with cast iron grate dome, underdeck clamp, 6" outlet. Provide 2" internal water dam.

300.3 FLOOR DRAINS

- A. Floor drains shall be in accordance with ANSI A112.21.1. Provide caulking flange for connection to cast iron pipe, screwed outlets for connection to steel pipe, and side outlet when shown. Provide suitable clamping device and extensions if required, where installed in connection with waterproofing membrane. (Submit detailed shop drawings for these drains.) Double drainage pattern floor drains shall have integral seepage pan for embedding in floor construction, and weep holes to provide adequate drainage from pan to drain pipe.

300.4 TRAPS

- A. Provide cast brass "p" traps on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed traps shall be polished brass chromium plated with nipple and set screw escutcheons. Concealed traps may be wrought cast brass. Slip joints not permitted on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture, or as scheduled.
- B. All drains, overflow, condensate and relief, to be routed to nearest trapped hub or floor drain if not shown on drawings.

300.5 DRAINS

- A. Contractor shall install all floor and roof drains according to manufacturer's recommendations. Provide and install all flashing and weatherproofing as required. Adjust extension sections on all drains as required for proper height adjustment.
- B. All floor drains to be trapped. Connect floor drains to sanitary waste piping as indicated on plans.
- C. Each AC equipment drain opening which normally discharges water (such as air conditioning unit drains, overflows, and similar drips and drains) shall be connected to the drain openings by means of an indirect drain or piped down directly over the floor drains which are provided for this purpose.
- D. Each water relief valve discharge shall be piped down to 6 inches above floor, but not necessarily over a floor drain or connected to a drain opening, unless otherwise indicated. No drain piping is required from the discharges or drain valves, unless otherwise indicated.

SECTION 15350

NATURAL GAS PIPING SYSTEM

350.1 PIPE

- A. All pipe and fitting used for gas piping system shall be as per Sections 15100 and 15120.

350.2 GAS UTILITY

- A. Gas service shall be coordinated with local gas utility and contractor shall pay all fees and deposits for connection to gas utility. All easements, etc. are the responsibility of the serving utility.

SECTION 15500

FIRE PROTECTION SYSTEM

500.1 SCOPE

- A. Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Plans.
- B. The Contractor shall install a complete wet pipe sprinkler system including heads, alarm valve, retard chamber, flow switches, O.S. & Y. valves and other appurtenances as shown on plans or as specified for all first floor areas.
- C. The system shall include all piping, valves, fittings, alarms, and heads required for the type of construction and as required by Owner's insurance and local fire authority requirements.
- D. Standard Products: Equipment furnished under this Specification is essentially the standard product of the manufacturer. Where two or more units of same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the products of the same manufacturer.

500.2 SUBMITTALS

- A. Manufacturer's literature for:
 - 1. Fire Department Connections
 - 2. Sprinkler Head
 - 3. O.S.& Y. Valve(s)
 - 4. Flow Switch(es)
 - 5. Alarm Valve
 - 6. Water Motor Alarm Valve
- B. Submit complete hydraulic calculations, sprinkler, stand-pipe connection and piping layout for approval. Identify all sprinkler head types. Provide drawing to scale on 24 inch and 36 inch sheet, number of copies per Section 15010. Obtain Mississippi State Rating Bureau and State Fire Marshall and National Board Underwriters approval and submit with other data. Coordinate with Architect/Engineer concerning acceptable spaces for drops prior to shop drawing submittal. Contact Architect/Engineer for clarification as required.

Submit two (2) sets of manufacturer's equipment data sheets, hydraulic calculations, and all related documents through the contracting officer to Division of Safety and Risk Management (AHJ) for review and approval (25 BIAM, Supplement 18, 1.5 A(6)).

500.3 APPLICABLE STANDARDS

- A. All equipment used must meet the requirements of the National Board of Fire Underwriters for the service intended.

- B. The Contractor shall conform to standards prescribed by NFPA-13 regulations or ordinances having jurisdiction and be approved by the Owner's insurance company. Any changes that may be necessary to conform to such regulations or ordinances shall be made by the Contractor without extra costs to the Owner.

500.4 GENERAL REQUIREMENTS

- A. The entire work must be executed in a neat, substantial, and workman-like manner, according to the true intent and meaning of the plans and specifications, which are intended to include everything dependent upon them and required for the completion of the work with materials best adapted to the purpose.
- B. The interior sprinkler systems shall be designed for Ordinary Hazard occupancy. Verify local pressure with local fire marshal and submit with hydraulic calculations.
- C. The hydraulic calculations shall provide for a minimum 10% safety factor.

500.5 EQUIPMENT

- A. Unless otherwise shown, specified, or approved by the Architect/Engineer, use materials and equipment in the installation of the sprinkler system listed as approved by the Underwriter's Laboratories Inc. List of Inspected Fire Protection Equipment and Materials, or approved by any other appropriate nationally known and recognized testing laboratory for use in sprinkler systems, and of the latest design of the manufacturer.
- B. Fire Department Connection: Use Siamese-type on exterior installation and furnish hose ends threaded with American National Fire-Hose-Coupling Threads, or with the proper threads for use with the local Fire Department hose. Thread pipe ends for 4-inch pipe as required. The completed installations shall include a check valve, ball drip, and metal escutcheon plate marked "auto spkr", 2-way 4" x 2-1/2" type. Provide 2-1/2 inch fire department connection hose valves, Potter-Roemer Figure 4085-D and 4115-D for top and all other floors, respectively. Provide matching polished chrome cap and chain.
- C. Sprinkler Heads: Unless otherwise specified or shown, provide and install sprinkler heads of regular automatic pop-down, recessed type concealed, for ordinary degree temperature rating except that temperature ratings of sprinkler heads installed in the vicinity of heating equipment shall be as required for such locations by National Board of Fire Underwriters' Pamphlet No. 13, where, in the opinion of the Owner's insurance company, special occupancies indicate the need for high-temperature rating for such heads by actual tests at the site. Provide 285°F temperature heads in mechanical and electrical areas as indicated. Utilize brass type heads in mechanical and electrical rooms and other core spaces without ceiling. Sidewall sprinklers shall be listed for "Ordinary Hazard" occupancy classification (NFPA 13, 5-4.2).
- D. Piping: Schedule 40 black steel piping, size as allowed by NFPA 13. All piping for Sanctuary wet pipe system and the entire dry pipe system shall be Schedule 40 galvanized.
- E. Pipe Hangers: Use types indicated as acceptable in National Board of Fire Underwriters' Pamphlet No. 13.
- F. Sprinkler Contractor shall provide the following for connection to fire alarm by Electrical Contractor:

1. All valve supervisory switches control.
 2. Sprinkler riser flow switch.
- G. Sprinkler Contractor shall provide and install locking access key box in a location as directed by Owner. Key to main front door entrance and egress corridor at location of fire alarm panel shall be located in box such that Fire Department personnel can access fire alarm panel. Access key box shall be obtained and coordinated with local Fire Department authority. Cost and coordination by Sprinkler Contractor.
- H. Provide a fire cabinet to hold replacement space sprinkler heads (never less than six) and six replacement heads for each system.

500.6 WATER CONNECTION

- A. Connect to piping outside building as shown on plans. Underground lines shall be Class 51 ductile iron with mechanical joints.
- B. Run all underground lines and install thrust-blocks as required to constrain all bends or connections.
- C. This contractor to conduct fire main flow test to ensure adequate pressure at main.

500.7 PIPE AND FITTINGS ABOVE GROUND

- A. Installation: Install pipe, fittings, and hangers where shown on drawings in accordance with NFPA Pamphlet No. 13. If Victaulic fittings are used, provide flush seal gaskets on dry pipe system.
- B. Cutting Structural Members: Cutting of structural members for the passage of sprinkler piping or for pipe-hanger fastenings will not be permitted unless approved by Architect/Engineer.
- C. Holes through Walls, Floors, and Ceilings: Where sprinkler pipes pass through walls, floors, and ceilings, the holes shall be large enough to accommodate pipe expansion. Provide chrome plated escutcheon at each hole to ensure the effectiveness of the floor or wall as a fire stop. Provide fireproof material around pipes to maintain fire integrity. Expansion and Contraction: Provide sleeves at floor penetrations to permit free movement resulting from expansion and contraction.
- D. Reducers: Make reductions in pipe sizes with one-piece reducing fittings. Bushings not acceptable, except that when one-piece reducing fittings of proper size are not obtainable, single bushings of the face type will be permitted up to 5 percent of total number of reducing fittings in the system. Where face bushings are used, install with outer face flush with the face of fitting opening being reduced.
- E. Couplings: Couplings not to be used except where length of pipe between fittings exceeds 20 feet.
- F. Flanges Fittings: Use flanged fittings in the control valve and drain assembly at base of risers of multiple-story sprinkler systems at each floor-system connection. Where part of a sprinkler system is on the opposite side of a wall or partition, a flanged connection may be used.

- G. Unions and Companion Flanges: Use ground-joint malleable iron unions in looper sprinkler systems where pipe is 2 inches in diameter or smaller. Where loops larger than 6 inches are used, install companion flanges.

500.8 DRAINS

- A. Install main drains on main risers and auxiliary drains at low points in the system. Install inspector's test drains on each sprinkler system as near the outer end of system as possible where a 1-1/4 inch branch line pipe is available. Five or fewer heads will not require a drain valve but may be drained through a plugged fitting. Drain valves to be of the angle type. Install in accordance with NFPA Pamphlet No. 13. Pipe drain valves to a safe place of discharge; discharge to be visible either by open end drain pipe or sight drain fitting.

500.9 TAMPER SWITCHES

- A. Provide tamper switches at all locations as indicated and required by Owner's insurance company and Fire Department Authorities. Sprinkler Contractor shall furnish and install switches with wiring by Electrical Contractor. Provide O.S. & Y valves with supervisory switch at each floor distribution main.

500.10 WATER FLOW INDICATOR SWITCHES

- A. Provide water flow indicator switches at all locations as indicated and as required by Owner's insurance company and Fire Department Authorities. Sprinkler Contractor shall furnish and install switches with wiring by Electrical Contractor.

500.11 FIRE ALARM

- A. Provide water motor gong on exterior wall in a location as shown on Plans or as directed by Architect/Engineer.
- B. The Electrical Contractor shall provide all wiring and interlocks as required for connection to the building fire alarm system. See Division 16000 for further requirements.

500.12 TESTS

- A. Upon completion and prior to the acceptance of the installation, subject the system to the tests required by Fire Department Authorities and the Owner's insurance company and NFPA Pamphlet No. 13, Paragraphs 110 and 111, and furnish the Owner with a certificate as acceptable by same. Wet system shall be subjected to 2 hour 200 PSI hydrostatic test with no leakage. If any leaks are detected, they will be repaired and the system will be retested.

500.13 INSTALLATION INSTRUCTIONS

- A. All main and distribution piping routed above ceiling shall be routed in joist space. Offset below solid beam and truss ceiling member as required and return to joist space

500.14 GUARANTEE

- A. The automatic sprinkler systems to be furnished under this section of the specifications shall be guaranteed for a period of one year from the date of final acceptance by Owner against defective materials, designs, and workmanship. Upon receipt of notice from the Owner of

failure of any part of the guaranteed equipment during the guaranty period, the affected part of parts shall be replaced promptly with new parts by and at the expense of the Contractor.

SECTION 15720

INDOOR CENTRAL STATION AIR HANDLER

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Applied Air Handling Units.

1.02 RELATED SECTIONS

- A. Section 15751 - Glycol System.
- B. Section 15900 - Building Automation and Control Systems
- C. Section 15950 - Controls and Instrumentation.
- D. Section 16180 - Equipment Wiring Systems: Electrical supply to units.
- E. Section 01513 - Temporary Heating, Cooling, and Ventilating.
- F. Section 15121 - Expansion Compensation.
- G. Section 15290 - Duct Work Insulation.

1.03 REFERENCES

- A. AMCA Publication 99 – Standards Handbook.
- B. AMCA Publication 611 – Certified Ratings Program – Airflow Measurement Performance
- C. AMCA Standard 500-D – Laboratory Methods of Testing Dampers for Rating.
- D. ANSI/ABMA Standard 9 - Load Ratings and Fatigue Life for Ball Bearings.
- E. ANSI/AMCA Standard 204 – Balance Quality and Vibration Levels for Fans.
- F. ANSI/AMCA Standard 610 – Laboratory Methods of Testing Airflow Measuring Stations for Rating.
- G. ANSI/AHRI Standard 410 - Forced Circulation Air-Cooling and Air-Heating Coils.
- H. ANSI/AHRI Standard 430 - Central Station Air Handling Units.
- I. ANSI/AHRI Standard 1060 – Rating Air-To-Air Energy Recovery Ventilation Equipment
- J. ANSI/ASHRAE Standard 52.2 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

- K. ANSI/ASHARE Standard 62.1 – Ventilation for Acceptable Indoor Air Quality.
- L. ANSI/ASHARE Standard 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings.
- M. ANSI/NEMA MG 1 – Motors and Generators.
- N. ANSI/UL 900 – Standard for Safety Air Filter Units.
- O. AHRI Standard 260 – Sound rating of Ducted Air Moving and Conditioning Equipment.
- P. ASHRAE Standard 84 - Method of Testing Air-to-Air Heat Exchangers.
- Q. ASHRAE Standard 111 – Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.
- R. ASTM B117 - Standard Practice for Operation Salt Spray Apparatus.
- S. ASTM C1071 – Thermal and Acoustic Insulation (Mineral Fiber, Duct Lining Material).
- T. ASTM C1338 – Standard Test Method for Determining Fungi Resistance of Insulation Material and Facings.
- U. ASTM E477 – Standard Test Method for Measure Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
- V. NFPA 70 – National Electrical Code[®].
- W. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilation Systems.
- X. UL 1995 – Standard for Safety Heating and Cooling Equipment

1.04 QUALITY ASSURANCE

- A. Air Coils: Certify capacities, pressure drops and selection procedures in accordance with current AHRI Standard 410.
- B. Air handling units with fan sections utilizing single fans shall be rated and certified in accordance with AHRI Standard 430.
- C. Air handling units with fan sections utilizing multiple fans shall be rated in accordance with AHRI Standard 430 for airflow, static pressure, and fan speed performance.
- D. Airflow monitoring station: Certify airflow measurement station performance in accordance with AMCA 611.
- E. ISO 9001 Certification.

1.05 SUBMITTALS

- A. No equipment shall be fabricated or delivered until the receipt of approved shop drawings from the Owner or Owner's approved representative.
- B. AHU manufacturer shall provide the following information with each shop drawing/product data submission:
 - 1. Dimensioned arrangement drawings for each AHU including a plan and elevation view of the assembled unit with overall dimensions, lift points, unit shipping split locations and dimensions, installation and operating weights, and installation, operation and service clearances.
 - 2. All electrical, piping, and ductwork requirements, including sizes, connection locations, and connection method recommendations.
 - 3. Each component of the unit shall be identified and mechanical specifications shall be provided for unit and accessories describing construction, components, and options.
 - 4. All performance data, including capacities and airside and waterside pressure drops, for components.
 - 5. Fan curves shall be provided for fans with the design operating points indicated. Data shall be corrected to actual operating conditions, temperatures, and altitudes.
 - 6. For units with multiple fans, a fan curve shall be provided showing the performance of the entire bank of fans at design conditions. In addition, a fan curve shall be provided showing the performance of each individual fan in the bank of fans at design conditions. Finally, a fan curve shall be provide showing the performance of the bank of fans when one fan is down. The percent redundancy of the bank of fans with one fan down shall be noted on the fan curve or in the tabulated fan data.
 - 7. A filter schedule must be provided for each air handling unit supplied by the air handling unit manufacturer. Schedule shall detail unit tag, unit size, corresponding filter section location within the AHU, filter arrangement (e.g. angled/flat), filter depth, filter type (e.g. pleated media), MERV rating, and filter quantity and size.
 - 8. A schedule detailing necessary trap height shall be provided for each air handling unit. Schedule shall detail unit tag, unit size, appropriate trap schematic with recommended trap dimensions, and unit supplied base rail height. Contractor shall be responsible for additional trap height required for trapping and insulation beyond the unit supplied base rail height by adequate housekeeping pad.
 - 9. An electrical MCA – MOP schedule shall be provided for each electrical circuit to which field-power must be supplied. Schedule to detail unit tag, circuit description, voltage/phase/hertz, Minimum Circuit Ampacity (MCA), and calculated Maximum Overcurrent Protection (MOP).
 - 10. Sound data shall be provided using AHRI 260 test methods. Unit discharge, inlet, and radiated sound power levels in dB shall be provided for 63, 125, 250, 500, 1000, 2000, 4000, and 8000 Hz.

- C. The AHU manufacturer shall provide appropriate sets of submittals as referenced in the General Conditions and shall submit to the Owner electronic copies of the IOM.
- D. The AHU manufacturer shall list any exceptions to the specification.

1.06 REGULATORY REQUIREMENTS

A. Agency Listings/Certifications

1. Unit shall be manufactured to conform to UL 1995 and shall be listed by either UL/CUL or ETL. Units shall be provided with listing agency label affixed to the unit. In the event the unit is not UL/CUL or ETL approved, the contractor shall, at his/her expense, provide for a field inspection by a UL/CUL or ETL representative to verify conformance. If necessary, contractor shall perform modifications to the unit to comply with UL/CUL or ETL as directed by the representative, at no additional expense to the owner.
2. Certify air handling units in accordance with AHRI Standard 430. Units shall be provided with certification label affixed to the unit. If air handling units are not certified in accordance with AHRI Standard 430, contractor shall be responsible for expenses associated with testing of units after installation to verify performance of fan(s). Any costs incurred to adjust fans to meet scheduled capacities shall be the sole responsibility of the contractor.
3. Certify air handling coils in accordance with AHRI Standard 410. Units shall be provided with certification label affixed to the unit. If air handling coils are not certified in accordance with AHRI Standard 410, contractor shall be responsible for expenses associated with testing of coils after installation to verify performance of coil(s). Any costs incurred to adjust coils to meet scheduled capacities shall be the sole responsibility of the contractor.
4. Certify airflow monitoring stations are tested for differential pressure in accordance with AMCA 611 in an AMCA registered laboratory and comply with the requirements of the AMCA Certified Ratings Program. Airflow monitoring station shall be licensed to bear the AMCA Seal.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- B. Units shall ship fully assembled up to practical shipping and rigging limitations. Units not shipped fully assembled shall have tags and airflow arrows on each section to indicate location and orientation in direction of airflow. Shipping splits shall be clearly defined on submittal drawings. Cost associated with non-conformance to shop drawings shall be the responsibility of the manufacturer. Each section shall have lifting lugs for field rigging and final placement of AHU sections. AHUs less than 100 inches wide shall allow for forklift transport for maneuverability on jobsite.
- C. Deliver units to jobsite with fan motor(s), sheave(s), and belt(s) completely assembled and mounted in units.

- D. Unit shall be shipped in a clear shrink-wrap or stretch-wrap to protect unit from in-transit rain and debris per ASHRAE 62.1 recommendations.
- E. Installing contractor shall be responsible for storing AHU in a clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.08 START-UP AND OPERATING REQUIREMENTS

- A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters in place, bearings lubricated (if applicable), condensate properly trapped, piping connections verified and leak-tested, belts aligned and tensioned, all shipping braces removed, bearing set screws torqued, and fan has been test run under observation.

1.09 WARRANTY

- A. AHU manufacturer shall provide, at no additional cost, a standard parts warranty that covers a period of one year from unit start-up or 18 months from shipment, whichever occurs first. This warrants that all products are free from defects in material and workmanship and shall meet the capacities and ratings set forth in the equipment manufacturer's catalog and bulletins.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. All air handling units shall be Trane Performance Climate Changer model which is the basis of design or equal by Carrier Racan Optimair. No other manufactures or models are approved.
- B. IF basis of design manufacturer and model is not provided, manufacturer must clearly define any exceptions made to Plans and Specifications if there are any exceptions. Any deviations in layout or arrangement shall be submitted to consulting engineer prior to bid date. Acceptance of deviation(s) from specifications shall be in the form of written approval from the consulting engineer. Air handling unit manufacturer is responsible for expenses that occur due to exceptions made, even if approval is provided by consulting engineer.

2.02 GENERAL

- A. Unit layout and configuration shall be as defined in project plans and schedule.
- B. Unit manufacturer to provide an integral base frame to support all sections of unit and raise unit for proper trapping. Contractor will be responsible for providing a housekeeping pad when unit base frame is not of sufficient height to properly trap unit. Unit base frames not constructed of galvanized steel shall be chemically cleaned and coated with both a rust-inhibiting primer and finished coat of rust-inhibiting enamel.
- C. Entire unit shall have a 6-inch full perimeter base rail for structural rigidity and condensate trapping.

2.02 UNIT CASING

- A. The entire air handler shall be constructed of galvanized steel. Casing finished to meet ASTM

B117 250-hour salt-spray test. The removal of access panels or access doors shall not affect the structural integrity of the unit. All removable panels shall be gasketed. All doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be responsible to provide connection flanges and all other framework that is needed to properly support the unit.

- B. Casing performance – Casing air leakage shall not exceed leak class 9 ($C_L = 9$) per ASHRAE 111 at specified casing pressure, where maximum casing leakage (cfm/100 ft² of casing surface area) = $C_L \times P^{0.65}$.
- C. Air leakage shall be determined at 1.50 times maximum casing static pressure up to 8 inches w.g. Specified air leakage shall be accomplished without the use of caulk. Total estimated air leakage shall be reported for each unit in CFM, as a percentage of supply air, and as an ASHRAE 111 Leakage Class.
- D. Under 55°F supply air temperature and design conditions on the exterior of the unit of 81°F dry bulb and 73°F wet bulb, condensation shall not form on the casing exterior. The AHU manufacturer shall provide tested casing thermal performance for the scheduled supply air temperature plotted on a psychrometric chart. The design condition on the exterior of the unit shall also be plotted on the chart. If tested casing thermal data is not available, AHU manufacturer shall provide, in writing to the Engineer and Owner, a guarantee against condensation forming on the unit exterior at the stated design conditions above. The guarantee shall note that the AHU manufacturer will cover all expenses associated with modifying units in the field should external condensate form on them.
- E. Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8" w.g., whichever is less, and shall not exceed 0.0042" per inch of panel span (L/240).
- F. Floor panels shall be double-wall construction and designed to support a 250-lb load during maintenance activities and shall deflect no more than 0.0042" per inch of panel span.
- G. Unit casing panels shall be 2" double-wall construction, with solid galvanized steel exterior and solid galvanized steel interior, to facilitate cleaning of unit interior.
- H. Unit casing panels (roof, walls, floor) and doors shall be provided with a minimum thermal resistance (R-value) of 13 Hr*Ft²*°F/BTU.
- I. Unit casing panels (roof, walls, floor) and external structural frame members shall be completely insulated filling the entire panel cavity in all directions so that no voids exist. Panel insulation shall comply with NFPA 90A.
- J. Casing panel inner liners must not extend to the exterior of the unit or contact the exterior frame. A mid-span, no-through-metal, internal thermal break shall be provided for all unit casing panels.
- K. Access panels and/or access doors shall be provided in all sections to allow easy access to drain pan, coil(s), motor, drive components and bearings for cleaning, inspection, and maintenance.
- L. Access panels and doors shall be fully removable without the use of specialized tools to allow complete access of interior surfaces.

2.04 Access Doors

- A. Access doors shall be 2" double-wall construction. Interior and exterior shall be of the same construction as the interior and exterior wall panels.
- B. All doors downstream of cooling coils shall be provided with a thermal break construction of door panel and door frame.
- C. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage.
- D. Door hardware shall be surface-mounted to prevent through-cabinet penetrations that could likely weaken the casing leakage and thermal performance.
- E. Handle hardware shall be designed to prevent unintended closure.
- F. Access doors shall be hinged and removable without the use of specialized tools to allow.
- G. Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference due to unforeseen job site obstructions.
- H. Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section.
- I. All doors shall be a minimum 60" high when sufficient height is available, or the maximum height allowed by the unit height.
- J. Multiple door handles shall be provided for each latching point of the door necessary to maintain the specified air leakage integrity of the unit. Alternately a single door handle shall be provided for each door linking multiple latching points necessary to maintain the specified air leakage integrity of the unit.

2.05 PRIMARY DRAIN PANS

- A. All cooling coil sections shall be provided with an insulated, double-wall, stainless steel drain pan.
- B. The drain pan shall be designed in accordance with ASHRAE 62.1 being of sufficient size to collect all condensation produced from the coil and sloped in two planes, pitched toward drain connections, promoting positive drainage to eliminate stagnant water conditions when unit is installed level and trapped per manufacturer's requirements. See section 2.07, paragraph F through H for specifications on intermediate drain pans between cooling coils.
- C. The outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.
- D. All drain pan threaded connections shall be visible external to the unit. Threaded connections under the unit floor shall not be accepted.
- E. Drain connections shall be of the same material as the primary drain pan and shall extend a minimum 2-1/2" beyond the base to ensure adequate room for field piping of condensate traps.

- F. The installing contractor is responsible to ensure the unit is installed level, trapped in accordance with the manufacturer's requirements, and visually inspected to ensure proper drainage of condensate.
- G. Coil support members inside the drain pan shall be of the same material as the drain pan and coil casing.
- H. Drain pans shall be provided for heating coils, access sections, and mixing sections as indicated in the plans.

2.06 FANS

- A. Fan sections shall have a minimum of one access door located on the drive side of the unit to allow inspection and maintenance of the fan, motor, and drive components. Construct door(s) per Section 2.04.
- B. Provide fans of type and class as specified on the schedule. Fan shafts shall be solid steel, coated with a rust-inhibiting coating, and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. All fans shall be statically and dynamically tested by the manufacturer for vibration and alignment as an assembly at the operating RPM to meet design specifications. Fans controlled by variable frequency drives shall be statically and dynamically tested for vibration and alignment at speeds between 25% and 100% of design RPM. Fan wheels shall be keyed to fan shafts to prevent slipping.
- C. Belt-driven fans shall be provided with grease lubricated, self-aligning, anti-friction bearings selected for L-50 200,000-hour average life per ANSI/AFBMA Standard 9. Lubrication lines for both bearings shall be extended to the drive side of the AHU and rigidly attached to support bracket with zerk fittings. Lubrication lines shall be a clear, high-pressure, polymer to aid in visual inspection. If extended lubrication lines are not provided, manufacturer shall provide permanently lubricated bearing with engineering calculations for proof of bearing life.
- D. All fans, including direct-drive plenum fans, shall be mounted on spring isolation bases. Internally-mounted motor shall be on the same isolation base. Fan and motor shall be internally isolated with spring isolators. Unit sizes up to nominal 4,000 cfm shall have 1-inch springs. Unit sizes larger than nominal 4,000 cfm shall have 2-inch spring isolators. A flexible connection (e.g. canvas duct) shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished and installed by AHU manufacture in the field in order to avoid transmission of noise and vibration through the ductwork and building structure.
- E. Fan sections containing multiple fans shall be provided as indicated on the schedule and drawings. Each fan shall operate in parallel to each other fan in the array. The fans shall be SWSI plenum type with high efficient AF blades. Fans shall be direct-driven. Fan wheels shall be aluminum. The Hp characteristic of the fans shall be non-overloading.
- F. Fan sections containing multiple fans shall be controlled using a common control signal, such as the duct static control signal, to modulate the fan speed.
- G. Belts shall be enclosed as required by OSHA standard 29 CFR 1910 to protect worker from accidental contact with the belts and sheaves.

H. MOTORS AND DRIVES

1. All motors and drives shall be factory-installed and run tested. All motors shall be installed on a slide base to permit adjustment of belt tension. Slide base shall be designed to accept all motor sizes offered by the air-handler manufacturer for that fan size to allow a motor change in the future, should airflow requirements change. Fan sections without factory-installed motors shall have motors field installed by the contractor. The contractor shall be responsible for all costs associated with installation of motor and drive, alignment of sheaves and belts, run testing of the motor, and balancing of the assembly.
2. Motors shall meet or exceed all NEMA Standards Publication MG 1 – 2006 requirements and comply with NEMA Premium efficiency levels when applicable. Motors shall comply with applicable requirements of NEC and shall be UL Listed.
3. Fan Motors shall be heavy duty, ODP type and exceeding the EPA efficiency requirements.
4. Belt-driven fan sections with single fans shall use 4-pole 1800 rpm motors, NEMA Design B, with Class B insulation to operate continuously at 104°F (40°C) ambient without tripping of overloads.
5. Direct-driven fan sections shall use 2-pole (3600 rpm), 4-pole (1800 rpm), or 6-pole (1200 rpm) motors, NEMA Design B, with Class B insulation to operate continuously at 104°F (40°C) ambient without tripping of overloads. Multiple fan selections utilizing 8-pole (900 rpm) motors are unacceptable due to motor inefficiency, cost, and replacement lead times.
6. Motors shall have a +/- 10 percent voltage utilization range to protect against voltage variation.
7. V-Belt Drive shall be rated at 1.5 times the motor nameplate. Drives 20 hp and larger or any drives on units equipped with VFDs shall be fixed pitch. Other drives will be variable pitch.
8. All fans with fixed-pitch drives and motors 15 hp and larger shall be equipped with multiple belt drives.
9. Manufacturer shall provide for each fan a nameplate with the following information to assist air balance contractor in start up and service personnel in maintenance:
 - a. Fan and motor sheave part number
 - b. Fan and motor bushing part number
 - c. Number of belts and belt part numbers
 - d. Fan design RPM and motor HP
 - e. Belt tension and deflection
 - f. Center distance between shafts

2.07 COILS

- A. Coils section side panels shall be removable to allow for removal and replacement of coils

without impacting the structural integrity of the unit.

- B. Install coils such that headers and return bends are enclosed by unit casing to ensure that if condensate forms on the header or return bends, it is captured by the drain pan under the coil.
- C. Coils shall be manufactured with plate fins to minimize water carryover and maximize airside thermal efficiency. Fin tube holes shall have drawn and belled collars to maintain consistent fin spacing to ensure performance and air pressure drop across the coil as scheduled. Tubes shall be mechanically expanded and bonded to fin collars for maximum thermal conductivity. Use of soldering or tinning during the fin-to-tube bonding process is not acceptable due to the inherent thermal stress and possible loss of bonding at that joint.
- D. Construct coil casings of galvanized steel. End supports and tube sheets shall have belled tube holes to minimize wear of the tube wall during thermal expansion and contraction of the tube.
- E. All coils shall be completely cleaned prior to installation into the air handling unit. Complete fin bundle in direction of airflow shall be degreased and steam cleaned to remove any lubricants used in the manufacturing of the fins, or dirt that may have accumulated, in order to minimize the chance for water carryover.
- F. When two or more cooling coils are stacked in the unit, an intermediate drain pan shall be installed between each coil. The intermediate drain pan shall be designed being of sufficient size to collect all condensation produced from the coil and sloped to promote positive drainage to eliminate stagnant water conditions. The intermediate drain pan shall be constructed of the same material as the primary drain pan.
- G. The intermediate drain pan shall begin at the leading face of the water-producing device and be of sufficient length extending downstream to prevent condensate from passing through the air stream of the lower coil.
- H. Intermediate drain pan shall include downspouts to direct condensate to the primary drain pan. The intermediate drain pan outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.
- I. Hydronic Coils
 1. Supply and return header connections shall be clearly labeled on unit exterior such that direction of coil water-flow is counter to direction of unit air-flow.
 2. Coils shall be proof-tested to 300 psig and leak-tested to 200 psig air pressure under water.
 3. Headers shall be constructed of round copper pipe or cast iron.
 4. Tubes shall be 1/2 inch O.D., minimum 0.016 inch thick copper. Fins shall be aluminum.
 5. Hydronic coils shall be supplied with factory installed drain and vent piping to the unit exterior.

2.08 FILTERS

- A. Provide factory-fabricated filter section of the same construction and finish as unit casings. Filter section shall have filter guides and access door(s) extending the full height of the casing to facilitate filter removal. Construct doors in accordance with Section 2.04. Provide fixed filter blockoffs as required to prevent air bypass around filters. Blockoffs shall not need to be removed during filter replacement.
- B. Filter type, MERV rating, and arrangement shall be provided as defined in project plans and schedule. If filters are not specified on the plans, provide MERV 8, 2", pleated media filters.
- C. Manufacturer shall provide one set of filters.
- D. Each filter section shall be provided with a factory-installed, flush-mounted Dwyer dial-type differential pressure gauge piped to both sides of the filter to indicate status. Gauge shall maintain a +/- 5 percent accuracy within operating temperature limits of -20°F to 120°F. Filter sections consisting of pre- and post-filters shall have a gauge for pre-filters and a second gauge for post-filters.

2.09 DAMPERS AND AIR FLOW MEASURING STATIONS

- A. Return air dampers shall be premium ultra low leak, internally mounted and parallel blade. Dampers shall be factory furnished and installed Ruskin CD60 double-skin airfoil design or equivalent for minimal air leakage and pressure drop. Leakage rate shall not exceed 4 CFM/square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage and shall be AMCA licensed for Class 1A. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D. Manufacturer shall submit brand and model of damper(s) being furnished, if not Ruskin CD60.
- B. Outside air airflow measuring stations with dampers shall be factory furnished and installed and located in the outside air path to measure and control outdoor airflow. Airflow measuring stations shall be tested per AMCA Standard 611 and licensed to bear the AMCA Ratings Seal for airflow measurement performance. Integral control damper blades shall be provided as galvanized steel and housed in a galvanized steel frame. Leakage rate shall not exceed 4 CFM/square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage.
 - 1. The airflow measurement station shall measure up to 100 percent of the total outside air. The airflow measurement station shall be capable of measuring down to 300 fpm. The airflow measuring device shall adjust for temperature variations. Output shall be provided from the station as a 2-10 VDC signal. Signal shall be proportional to air velocity. The accuracy of the measuring station shall be no greater than +/- 5 percent. Airflow measuring stations shall be mounted on the AHU interior.
 - 2. The ahu manufacturer shall provide and field install duct-mounted pleated media MERV 8 filtration upstream of airflow monitoring stations requiring air straightening vanes to prevent blockage of vanes. A filter access door shall be provided and field installed by the ahu manufacturer for filter replacement that does not degrade the specified duct leakage class. Duct-mounted filtration section with access door for filter removal shall be tested for compliance to specified duct leakage class.

2.10 ACCESS SECTIONS

- A. Access sections shall be provided between all adjacent coil sections and any other locations indicated on the plans. Access sections shall allow additional access for inspection, cleaning, and maintenance of unit components. The unit shall be installed for proper access. Procedure for proper access, inspection and cleaning of the unit shall be provided in the AHU manufacturer's maintenance manual. Provide at least one access door in each access section. Access section doors shall be constructed per Section 2.04.

2.11 DISCHARGE PLENUM SECTIONS

- A. Discharge plenums shall be provided at the discharge of the supply air fan to efficiently turn air and provide acoustical attenuation. Discharge plenum opening types and sizes shall be scaled so that scheduled motor horsepower is not exceeded at schedule ESP. Scheduled ESP does not include air pressure drop of discharge plenum.

2.12 MARINE LIGHTS

- A. Marine lights shall be provided in the damper/mixing box section, each access section and each fan sections of the air handling unit. Lights shall be instant-on, light-emitting diode (LED) type to minimize amperage draw and shall produce lumens equivalent to a minimum 75W incandescent bulb (1200 lumens). LED lighting shall provide instant-on, white light and have a minimum 50,000 hr life.
- B. Light fixture shall be weather-resistant, enclosed and gasketed to prevent water and dust intrusion.
- C. Fixtures shall be designed for flexible positioning during maintenance and service activities for best possible location providing full light on work surface of interest and not being blocked by technician. Technician must be able to move each light fixture from one surface to another within a given section of the air handling unit without the use of tools and without disconnecting power to the fixture.
- D. All lights on a unit shall be wired in the factory to a single on-off switch.
- E. Installing contractor shall be responsible for providing 115V supply to the factory-mounted marine light circuit.

2.13 CONVENIENCE OUTLETS

- A. A 15-amp, 115V GFCI convenience outlet shall be provided by the AHU manufacturer. The outlet shall be separate from the load side of the equipment per NEC requirements. Installing contractor shall be responsible for providing 115V supply to the factory-mounted GFCI outlet circuit per NEC (even when single-point power is specified to be provided by AHU manufacturer).

PART 3 EXECUTION

3.01 SHIPPING

- A. Paper copies of the IOM shall also be shipped with each AHU.

- B. The AHU manufacturer shall identify all shipments with the order number. Enough information shall be provided with each shipment to enable the Mechanical Contractor to confirm the receipt of units when they are received. For parts too small to mark individually, the AHU manufacturer shall place them in containers.
- C. To protect equipment during shipment and delivery, all indoor units shall be completely stretch or shrink wrapped. Wrap shall be a minimum of 7 mil plastic. Pipe ends and pipe connection holes in the casing shall be capped or plugged prior to shipment.
- D. After loading the equipment for shipment, the AHU manufacturer shall contact the shipping contact on the order and provide the name of the carrier, description of equipment, order number, shipping point, and date of shipment.

3.02 ON-SITE STORAGE

- A. If equipment is to be stored for a period of time prior to installation, the Mechanical Contractor shall remove all stretch or shrink wrap from units upon receipt to prevent unit corrosion and shall either place the units in a controlled indoor environment or shall cover the units with canvas tarps and place them in a well-drained area. Covering units with plastic tarps shall not be acceptable.

3.03 FIELD EXAMINATION

- A. The Mechanical Contractor shall verify that the mechanical room and/or roof are ready to receive work and the opening dimensions are as indicated on the shop drawings and contract documents.
- B. The Mechanical Contractor shall verify that the proper power supply is available prior to starting of the fans.

3.04 INSTALLATION

- A. The Mechanical Contractor shall be responsible to coordinate ALL of his installation requirements with the Owner and the Owner's selected Mechanical Contractor to ensure that a complete installation for each unit is being provided. Coordination efforts shall include such items as unloading and hoisting requirements, field wiring requirements, field piping requirements, field ductwork requirements, requirements for assembly of field-bolted or -welded joints, and all other installation and assembly requirements.
- B. The AHU manufacturer shall provide all screws and gaskets for joining of sections in the field.
- C. The Mechanical Contractor shall verify that he has completed the following items prior to starting up the air handling units:
 - 1. All spring-isolated components have had their shipping restraints removed and the components have been leveled.
 - 2. On all field-joined units, that all interconnections have been completed, i.e., electrical and control wiring, piping, casing joints, bolting, welding, etc.

3. All water and steam piping connections have been completed and hydrostatically tested and all water flow rates have been set in accordance with the capacities scheduled on the Drawings.
4. All ductwork connections have been completed and all ductwork has been pressure tested for its intended service.
5. All power wiring, including motor starters and disconnects, serving the unit has been completed.
6. All automatic temperature and safety controls have been completed.
7. All dampers are fully operational.
8. All shipping materials have been removed.
9. All (clean) filter media has been installed in the units.

3.05 LEVELING

- A. The Mechanical Contractor shall level all unit sections in accordance with the unit manufacturer's instructions. The Mechanical Contractor shall provide and install all necessary permanent shim material to ensure individual sections and entire assembled units are level.

3.06 FINAL INSPECTION AND START UP SERVICE

- A. After the Mechanical Contractor has provided all water and steam piping connections, ductwork connections, and field control wiring, and Electrical Contractor has provided all the field power wiring, the Mechanical Contractor shall inspect the installation. The Mechanical Contractor shall then perform startup of the equipment.
- B. The Automatic Temperature Control (Building Direct Digital Control) Contractor shall be scheduled to be at the job site at the time of the equipment start up.
- C. The Mechanical Contractor, shall perform the following tests and services and submit a report outlining the results:
 1. Record date, time, and person(s) performing service.
 2. Lubricate all moving parts.
 3. Check all motor and starter power lugs and tighten as required.
 4. Verify all electrical power connections.
 5. Conduct a start up inspection per the AHU manufacturer's recommendations.
 6. Record fan motor voltage and amperage readings.
 7. Check fan rotation and spin wheel to verify that rotation is free and does not rub or bind.

8. Check fan for excessive vibration.
9. Check V belt drive or coupling for proper alignment.
10. Check V belt drive for proper tension. Tighten the belts in accordance with the AHU manufacturer's directions. Check belt tension during the second and seventh day's operation and re-adjust belts, as may be required, to maintain proper tension as directed by the AHU manufacturer.
11. Remove all foreign loose material in ductwork leading to and from the fan and in the fan itself.
12. Disengage all shipping fasteners on vibration isolation equipment.
13. Check safety guards to insure they are properly secured.
14. Secure all access doors to the fan, the unit and the ductwork.
15. Switch electrical supply "on" and allow fan to reach full speed.
16. Physically check each fan at start up and shut down to insure no abnormal or problem conditions exist.
17. Check entering and leaving air temperatures (db and wb) and simultaneously record entering and leaving chilled water temperatures and flow and outside air temperature.

SECTION 15740

HIGH EFFICIENCY CONDENSING HEATING WATER BOILERS

PART 1 - GENERAL

1.1 SCOPE

- A. The work to be performed includes all new equipment, labor and materials required to furnish and install high-efficiency Pulse hydronic boilers as described in this specification.

1.2 REFERENCES

- A. ASME Section IV.
- B. ASME CSD1 - Controls and Safety Devices.
- C. ANSI Z21.13.
- D. CSA - CGA/AGA
- E. GE GAP
- F. NEC - National Electrical Code

1.3 SUBMITTALS

- A. **Product Data:** Submit manufacturer's technical product data, including rated capacities of selected model, weights (shipping, installed, and operating), installation and start-up instructions, along with furnished accessory information.
- B. **Shop Drawings:** Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.
- C. **Wiring Diagrams:** Submit manufacturer's electrical requirements for boilers including ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
- D. Approved equal manufacturer's are Fulton Pulse or Viessman.

1.4 QUALITY ASSURANCE

- A. **Manufacturer's Qualifications:** Firms regularly engaged in the manufacturing of pulse combustion, high efficiency, condensing boilers, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 10 years.
- B. The hot water boiler maximum working pressure will be 160 psig.
- C. Pulse Boiler Flame Safeguard Control will be of an accepted quality manufacturer bearing UL Certification.
- D. The entire boiler system and its installation shall conform to the manufacturer's instructions, applicable codes and associated National Board requirements.
- E. The equipment shall, as a minimum, be in strict compliance with the requirements of this specification and shall be the manufacturer's standard commercial product unless

specified otherwise. Additional equipment features, details, accessories, etc. which are not specifically identified but which are a part of the manufacturer's standard commercial product, shall be included in the equipment being furnished.

- F. The equipment shall be of the type, design, and size that the manufacturer currently offers for sale and appears in the manufacturer's current catalog.
- G. The equipment shall fit within the allocated space, leaving ample allowance for maintenance and inspection.
- H. The equipment shall be new and fabricated from new materials. The equipment shall be free from defects in materials and workmanship.
- I. All units of the same classification shall be identical to the extent necessary to ensure interchangeability of parts, assemblies, accessories, and space parts wherever possible.
- J. In order to provide unit responsibility for the specified capacities, efficiencies, and performance, the boiler manufacturer shall certify in writing that the equipment being submitted shall perform as specified.

1.5 WARRANTY

- A. Boiler manufacturer shall guarantee in writing equipment to be free of defects for one year after start-up date or 18 months from factory shipment, and to repair or replace at manufacturer's expense any defective parts. Unit shall receive such factory tests as are deemed advisable by the manufacturer to check construction and operation.
- B. The pressure vessel shall be guaranteed against thermal shock for 10 years when utilized in a closed loop hydronic heating system with a maximum temperature differential rating of up to 170 °F. The boiler pressure vessel shall be guaranteed accordingly without a minimum flow rate or return water temperature requirement. The boiler shall not require the use of flow switches or other devices to ensure minimum flow.
- C. The pressure vessel shall carry a 10-year warranty against material and workmanship defects.
- D. The combustor and exhaust pipes (heat exchanger) shall be guaranteed against flue gas corrosion for a period of 10 years for carbon steel boilers and a period of 5 years for stainless steel boilers.
- E. All parts not covered by the above warranties shall carry a one-year warranty. This shall include all electrical and burner components.

PART 2 - PRODUCTS

2.1 BOILER CONSTRUCTION

- A. The exhaust decoupler shall be constructed of ¼" corrosion resistant Corten and include a flue gas condensate drain.
- B. The combustor shall be constructed of SA-53B ERW pipe.

- C. The pressure vessel shell shall be SA-53B ERW pipe or SA-285 Grade C plate. The heads shall be SA-516 Grade 70 plate. The pressure vessel shall be fully insulated with 2" of high temperature insulation.
- D. The pulse combustor location shall be such that all combustor assembly components are located within water-backed areas.
- E. The boiler's pressure vessel, combustor, and exhaust decoupler shall be encased in an 18 gauge metal cabinet with primer and finish coat of paint.
- F. Boilers utilizing copper heat exchanger construction are not acceptable.

2.2 BOILER DESIGN

- A. Boiler shall be fire-tube design, utilizing the principles of pulse combustion. The boiler shall be self-aspirating and require no forced or induced draft fan to supply air for combustion after ignition.
- B. External convection and radiation heat losses to the boiler room from the boiler shall be less than 0.5% of the rated boiler input. The boiler shall not contain any refractory, refractory lining or ceramic in the furnace or firebox.
- C. The boiler shall be designed for operation in a condensing mode, in order to extract the latent heat from the combustion products. The boiler shall have a minimum acceptable fuel-to-water efficiency of 91% at a return water temperature of 80 °F and at the full rated input capacity of the boiler. Overall efficiency at the low fire rated input capacity will be 98%.
- D. The boiler shall be able to operate without the use of a 3-way valves or primary/secondary piping loops.
- E. The boiler shall have no minimum return water temperature requirements.
- F. The boiler shall have no minimum flow rate requirements.

2.3 CONTROLS

- A. The flame safeguard system shall have an LED display module. The control shall provide a 35-second pre-purge and post-purge. The control shall maintain a running history of operating hours, number of cycles, and the most recent six faults. The control shall have the capability to be connected to a keyboard display module that will retrieve this information.
- B. Pulse Combustion controls shall include the following:
 1. Operating Temperature Controller for automatic start/stop of the pulse combustion process. Controller will have auto-tune PID capabilities for simplified loop configuration and fast response to water temperature fluctuations. A Type J temperature sensor shall be located in the boiler pressure vessel.
 2. High limit temperature aquastat with manual reset.
 3. One low water cutoff probe in the boiler shell with manual reset and push-to-test capability.
 4. Air safety switch to prevent operation unless sufficient pre-purge air is assured.

5. High condensate cut-off probe located in the exhaust decoupler.
 6. A Proof of Flame switch and Flame Rod operating in parallel, to prove combustion.
- C. A combustion control system shall be furnished which provides a turndown ratio of 5:1 per ANSI Z21.13 over the input range from high to low fire. The supply temperature and setpoint temperature shall be displayed at all times by the operating temperature control. Firing rate shall be controlled by a continuous 4-20mA analog signal to a modulation motor.
- D. All controls to be panel mounted and so located on the boiler as to provide ease of servicing the boiler without disturbing the controls and also located to prevent possible damage by water according to CSA requirements. Electrical power supply shall be 120 volts, 60 cycle, single phase, 10 Amps maximum. Boiler shall draw less than 1 Amp while in run mode. No additional electric power shall be required for devices such as forced draft fans.
- E. When multiple boilers are to be installed in a common hydronic loop, sequencing system shall be provided to stage the boilers. The controller shall incorporate a control sequence that will stage the boilers on at low fire and remain there until all stages have been enabled, and then keep them at the lowest firing rate possible, thereby keeping the boilers operating at peak efficiency, regardless of the heat load on the building.
- F. The controller shall include the following features:
1. Intuitive operator interface with touchscreen operator.
 2. Modbus RS-485 communication to each condensing boiler controlled using two wire twisted pair wiring.
 3. The panel shall also provide ModBus outputs to building energy management system showing status of the boilers. The following data shall be provided to the building energy management system:
 - Loop temperature Setpoint.
 - Outdoor Temperature.
 - Loop Temperature.
 - Condensing Boiler Status.
 - Condensing Boiler Firing Rate.
 - Condensing Boiler Alarm Condition.
 - Occupied/Unoccupied Mode.
 - Auto/Manual Loop Control.
 - 3-way Hot Water Reset Valve
 4. Occupied/Unoccupied mode setback with Day of week/time of day selection
 5. Lead/Lag boiler sequencing with automatic or manual rotation of lead boiler.
 6. Condensing boiler enable/disable and firing rate based on PID control variable providing accurate and fast responding temperature control.
 7. Outdoor Reset Controls to control loop temperature based on outdoor temperature.
 8. Condensing boiler alarm annunciation.

2.4 MAIN GAS TRAIN COMPONENTS

- A. The boiler shall have an integral gas train, factory assembled and installed. The main gas train will include:
1. One manual shut-off valve at gas inlet.
 2. Gas inlet trap.

3. Gas regulator rated for a maximum 14"wc supply pressure.
4. Two safety shut-off valves. One to be solenoid and one motorized valve.
5. Independent low and high gas pressure switches shall be supplied.

2.5 BOILER FITTINGS

- A. Boiler shall be supplied with a ASME Section IV approved, side outlet type safety valve. The safety relief valve size shall be in accordance with ASME code requirements.
- B. Temperature and pressure gauges shall be mounted on top of the boiler.
- C. A condensate drain connection shall be provided in the exhaust decoupler. A Fulton condensate drain kit will be provided to collect and drain the flue gas condensate.

2.6 INSTALLATION

- A. The boiler shall be CSA approved as a direct vent boiler. A conventional chimney or stack shall not be required. Direct venting shall be accomplished with AL-29-4C stainless steel, single (or double) wall. Vent piping shall be installed in accordance with applicable national and local codes and per the boiler manufacturers' recommendations.
- B. The boiler shall have the outside combustion air intake supply ducted with PVC pipe. An air intake muffler shall be provided by the boiler manufacturer and mounted within 10 feet of the boiler intake connection.
- C. An external muffler to be provided by the boiler manufacturer and mounted within 10 feet of the boiler exhaust connection.

2.7 EMISSIONS

- A. The boiler shall operate with CO emissions less than 100 PPM corrected to 3% O₂ and shall with NOx emissions less than 50 PPM corrected to 3% O₂ over the entire turndown range.

2.8 OPERATING MANUAL

- A. Instructions for installation, operation and maintenance of the boiler shall be contained in a manual provided with each boiler unit.
- B. A wiring diagram corresponding to the boiler configuration shall be permanently affixed to the boiler near the electrical panel.

2.9 OPTIONAL ACCESSORIES RQUIRED

- A. Each boiler to be provided with 1/3 HP In-Line pump to pump water through the boiler at any time that the boiler is firing to assure that the heated water goes into the heat pump loop. Pump is to be wired to the boiler control panel and is to be powered from that panel, no external power source is required.
- B. Provide a readout module for each flame safeguard controller to allow operators to view starting sequence and access error code history.

- C. Provide a condensate trap to serve the boilers. A fresh water supply must be piped to the trap by installer using 1/4" copper tubing.
- D. Boilers to have modulated gas firing controls.
- E. Boilers shall be vented using double wall vent material UL approved for venting Category IV appliances. Inner line shall be constructed of AL29-4C.
- F. Boilers must be started by factory trained field service technician.

PART 3 EXECUTION

3.0 INSTALLATION

- A. Equipment and materials shall be installed in an approved manner and in accordance with the boiler manufacturers' installation requirements.
- B. The installer shall construct a level continuous concrete pad (min. 3-1/2 inches high) for the entire boiler system according to the boiler manufacturer's erecting instructions.
- C. Assemble unit sections and parts shipped loose or unassembled for shipment purposes. Follow manufacturer's installation recommendations and instructions.
- D. Install electrical control items furnished by manufacturer per wiring diagram provided by manufacturer.
- E. Complete water piping installation as required by manufacturer for operation of system.
- F. Provide air intake and exhaust piping, size and type as recommended by the manufacturer.
- G. Provide boiler manufacturer recommended manifold pipe and fittings from each boiler to nearest floor drain or as indicated.

3.1 FIELD QUALITY CONTROL

- A. After boiler installation is completed, the manufacturer shall provide the services of a field representative for starting the unit and training the operator.
- B. Arrange with National Board of Boiler and Pressure Vessel Inspectors for inspection of boilers and piping. Obtain certification for completed boiler units, deliver to Owner, and obtain receipt.

SECTION 15745

HOT WATER HEATING SYSTEM

745.1 GENERAL

- A. Hot Water Heating System - The BAS shall start the lead pump below 65 F outside air temperature or call for heat. After proof of flow, the boilers packaged safety and operating controls shall be enabled to maintain their setpoint.
 - 1. The BAS shall reset hot water supply temperature by modulating a 3-way hot water valve. Reset schedule to be 190 F to 130 F hot water supply temperature as outside air varies from 5 F to 54 F. (adjustable)
 - 2. If the lead pump fails for 15 seconds or more, the lag pump shall start and an alarm sent to the BAS.

SECTION 15760

AIR COOLED ROTARY SCREW CHILLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Chiller package.
- B. Charge of refrigerant and oil.
- C. Controls and control connections.
- D. Chilled water connections.
- E. Starters.
- F. Electrical power connections.

1.02 RELATED SECTIONS

- A. Hydronic Piping.
- B. Section 15952 - Controls and Instrumentation.
- C. Section 16180 - Equipment Wiring Systems.

1.03 REFERENCES

- A. ANSI/ARI 550/590-2003 - Standard for Water Chilling Packages using the Vapor Compression Cycle.
- B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- C. ANSI/ASHRAE 90.1 - Energy Efficient Design of New Buildings.
- D. ANSI/ASME SEC 8 - Boiler and Pressure Vessel Code
- E. ANSI/NEMA MG 1 - Motors and Generators.
- F. ANSI/UL 1995 - Central Cooling Air Conditioners.
- G. ANSI/UL 984 - Safety Standard for Hermetic Motor Compressors.
- H. ANSI/AFBMA 9-1978 - Load Ratings and Fatigue Life for Ball Bearings. Bearings must have life of not less than L10 200,000 hours.
- I. California Administrative Code - Title 24
- J. ASTM B117 - Standard Method of Salt Spray (Fog) Testing
- K. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

- L. ASTM A525 - Zinc (Hot-Dip Galvanized) Coatings on Sheet Steel Products
- M. ASTM D1654 - Evaluation of Painted or Coated Specimens, Subjected to Corrosive Environments
- N. California Zone 4; where applicable

1.04 SUBMITTALS

- A. Submit eight (8) sets of drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections.
- B. Submit product data indicating rated capacities, operation data, weights, specialties and accessories, electrical requirements and wiring diagrams.
- C. Submit manufacturer's installation instructions including start-up instructions, maintenance data, controls, and accessories.
- D. Submit maintenance data.

1.05 REGULATORY REQUIREMENTS

- A. Conform to ANSI/ARI 550/590-2003 Standard for testing and certified rating of Water Chilling Packages using the Vapor Compression Cycle.
- B. Conform to ANSI/UL 1995 code for construction of water chillers. The unit shall be UL approved and bear the UL label.
- C. Conform to ANSI/ASME SEC 8 Boiler and Pressure Vessel Code for construction and testing of water chillers.
- D. Conform to ANSI/ASHRAE 15 code for construction and operation of water chillers.

1.06 STORAGE AND HANDLING

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- B. Protect units from physical damage. Factory coil shipping covers shall be kept in place until installation.

PART 2 PRODUCTS

2.01 SUMMARY

- A. The contractor shall furnish and install air-cooled water chillers as shown as scheduled on the contract documents. The chillers shall be installed in accordance with this specification and perform at the specified conditions as scheduled.
- B. The contractor shall furnish and install Trane or approved equal by York of size and capacity scheduled. Actual tonnage and EER shall be equal to or exceed that scheduled on the drawings. Unit shall be installed in strict accordance with this specification. All

units shall be furnished complete with helical rotary compressors, shell and tube evaporator, air-cooled condenser, expansion valves and microprocessor control panel. Total unit shall be UL certified and include the UL label. The unit shall be designed for outdoor application and painted. The unit shall be rated in accordance with ARI Standard 550/590-2003. Chiller shall be furnished with a one (1) year parts and labor warranty on the whole chiller from the date of acceptance of the project and four (4) additional years on compressor only.

2.02 COMPRESSORS

- A. Construct chiller using semi-hermetic helical rotary screw compressors with independent circuits.
- B. Statically and dynamically balance rotating parts.
- C. Provide oil lubrication system with oil charging valve and oil filter to ensure adequate lubrication during starting, stopping, and normal operation.
- D. Provide compressor with automatic capacity reduction equipment consisting of capacity control slide valve. Use lifting mechanism operated by oil pressure. Compressor must start unloaded for soft start on motors.
- E. Provide constant speed 3600 rpm compressor motor at 60 Hz, suction gas cooled, designed for across-the-line starting. Furnish with factory installed starters. Provide across-the-line starters for 460 volt chillers.
- F. Provide compressor heater to evaporate refrigerant returning to compressor during shut down. Energize heater when compressor is not operating.

2.03 EVAPORATOR

- A. Provide shell and tube type evaporator, seamless or welded steel construction with cast iron or fabricated steel heads, seamless internally and externally finned copper tubes, roller expanded into tube sheets.
- B. Provide water drain connection, vent and fittings for factory installed leaving water temperature control and low temperature cutout sensors.
- C. Water connections shall be flanged. Evaporator shall have only one entering and one leaving connection.

2.04 CONDENSER AND FANS

- A. Chiller shall be able to operate in ambient conditions down to 25 degrees F.
- B. Construct condenser coils of aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 510 psig.
- C. Provide vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Entire fan assembly shall be statically and dynamically balanced and fan assembly shall be either painted or zinc coated steel. Fan guard shall be either chrome or zinc coated.

- D. Provide Totally Enclosed Air Over (TEAO) fan motors with permanently lubricated ball bearings and built-in thermal overload protection.
- E. Provide factory mounted, louvered, “architecturally pleasing” guard panels. Panel louvers shall completely cover condenser, evaporator and compressor sections.

2.05 ENCLOSURES

- A. House components in a galvanized steel frame and mounted on welded structural steel base. Hot-dip galvanized steel frame coating shall be Underwriters Laboratories Inc. (UL) recognized as G90-U, UL guide number DTHW2.
- B. Unit panels and control panels shall be finished with a baked on powder paint. Control panel doors shall have door stays.
- C. Mount starters and Terminal Block in weatherproof panel provided with full opening access doors. Provide lockable through-the-door non-fused electrical disconnect operating handle or circuit breaker switch external to panel and clearly visible from outside of unit indicating if power is on or off.
- D. Casings shall be fabricated from steel that has a Zinc coating conforming to ASTM A 123 or ASTM A525.

2.06 REFRIGERANT CIRCUIT

- A. All units shall have 2 refrigeration circuits to provide redundancy, each with one compressor on each circuit. Single refrigerant circuit chillers are not acceptable.
- B. Provide for each refrigerant circuit:
 - 1. Liquid line shutoff valve.
 - 2. Filter (replaceable core type).
 - 3. Liquid line sight glass.
 - 4. Electronic or thermal expansion valve sized for maximum operating pressure.
 - 5. Charging valve.
 - 6. Discharge and oil line check valves.
 - 7. Compressor Discharge service valves.
 - 8. High side pressure relief valve.
 - 9. Full operating charge of HFC-134a and oil.
- C. Capacity Modulation: Provide capacity modulation that includes linear unloading to maintain close leaving water temperature control. Unit shall be capable of operation down to 15%. In the event manufacturer cannot provide a unit with modulation down to 15%, Hot Gas Bypass must be provided.

2.07 CONTROLS

- A. Chilled water temperature control shall be microprocessor-based, proportional and integral controller to show water and refrigerant temperature, refrigerant pressure, and diagnostics. This microprocessor-based controller is to be supplied with each chiller by the chiller manufacturer. Controls shall include the following readouts and diagnostics:
1. Phase reversal/unbalance/single phasing and over/under voltage protection.
 2. Low chilled water temperature protection.
 3. High and low refrigerant pressure protection.
 4. Load limit thermostat to limit compressor loading on high return water temperature.
 5. Condenser fan sequencing to automatically cycle fans in response to load, expansion valve pressure, and condenser pressure to optimize unit efficiency.
 6. Display diagnostics.
 7. Oil pressure control.
 8. Compressors: Status (on/off), %RLA, solid state anti-short cycle timer, and automatic compressor lead-lag.
- B. On chiller, mount weatherproof control panel, containing starters, power and control wiring, factory wired with single point terminal block power connection. Provide primary and secondary fused control power transformer and a single 115 volt single phase connection for evaporator freeze protection heaters.
1. The unit controller shall utilize the following components to automatically take action to prevent unit shutdown due to abnormal operating conditions which will perform as follows:
 - a. High pressure switch shall be set 20 PSIG lower than factory pressure switch and will automatically unload the compressor to prevent a high pressure condenser control trip. One switch shall be required for each compressor and indicating light shall be provided.
 - b. Motor surge protector shall be set at 95% of compressor RLA and will automatically unload the compressor to prevent an overcurrent trip. One protector shall be required for each compressor and indicating light.
 - c. Low pressure switch that shall be set at 5 PSIG above the factory low pressure switch and will automatically unload the compressor to prevent a low evaporator temperature trip. One switch shall be required for each compressor and indicating light.
- C. In the above case, the chiller will continue to run in an unloaded state, and will continue to produce some chilled water. If the chiller reaches the trip-out limits, the chiller controls will take the chiller off line for protection, and a manual reset will be required. Once the "near-trip" condition is corrected, the chiller will return to normal operation.
- D. Electrical Power: Provide factory installed starters for all chillers. For 460 volt chillers, provide each compressor with an across-the-line starter. Provide single point power

connection to power entire chiller. If chiller's rated MCA and/or MOP exceeds scheduled MCA and MOP, chiller manufacturer shall pay for all additional costs associated with providing larger electrical power services to each chiller. Provide lockable through-the-door non-fused electrical disconnect operating handle external to panel and clearly visible from outside of unit indicating if power is on or off.

E. Provide the following safety controls with indicating lights or diagnostic readouts.

1. Low chilled water temperature protection.
2. High refrigerant pressure.
3. Low oil flow protection.
4. Loss of chilled water flow.
5. Contact for remote emergency shut-down.
6. Motor current overload.
7. Phase reversal/unbalance/single phasing.
8. Over/under voltage.
9. Failure of water temperature sensor used by controller.
10. Compressor status (on/off).

F. Provide the following operating controls:

1. Modulating leaving chilled water temperature controller which modulates compressor slide valves based on PI algorithms.
2. Five minute solid state anti-recycle timer to prevent compressor from short cycling. Compressor minimum stop-to-start time limit shall be 2 minutes.
3. Chilled water pump output relay that closes when the chiller is given a signal to start.
4. Load limit thermostat to limit compressor loading on high return water temperature to prevent nuisance tripouts.
5. High ambient unloader pressure controller that unloads compressors to keep head pressure under control and help prevent high pressure nuisance tripouts.
6. Compressor current sensing unloader unit that unloads compressors to help prevent current overload nuisance tripouts.
7. Auto lead-lag functions that constantly even out run hours and compressor starts automatically.
8. Low ambient lockout control with adjustable setpoint.

9. Condenser fan sequencing which automatically cycles fans in response to ambient, condensing pressure and expansion valve pressure differential thereby optimizing unit efficiency.
- G. Provide user interface on the front of the panel. If display is on the inside of the panel, then a control display access door shall be provided to allow access to the display without removal of panels. Provide user interface the following features:
1. Leaving chilled water setpoint adjustment from LCD input.
 2. Entering and leaving chilled water temperature output.
 3. Percent RLA output for each compressor.
 4. Pressure output of condenser for circuits one and two.
 5. Pressure output of evaporator for circuits one and two.
 6. Ambient temperature output.
 7. Voltage output.
 8. Current limit setpoint adjustment from LCD input.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Align chiller package on concrete foundations.
- C. Connect to electrical service.
- D. Connect to chilled water piping.
- E. Arrange piping for easy dismantling to permit tube cleaning.

3.02 MANUFACTURER'S FIELD SERVICES

- A. Supply service of factory trained representative for a period of one day to supervise testing, start-up, and instruction on operation and maintenance to Owner.
- B. Supply initial charge of refrigerant and oil.

3.03 CHILLER SUPPORT

- A. Provide a 6" thick reinforced concrete "housekeeping" slab under each chiller that is 2' larger in each direction than footprint of chiller. Provide rubber isolation pad around perimeter of each chiller.

SECTION 15780

FAN COIL UNITS

780.1 GENERAL

- A. Unit capacities certified under the Room Fan-Coil Air Conditioner Certification Program and shall be rated in accordance with ARI Standard 440-89. Unit shall be tested and rated in accordance with ARI Standard ANSI-S1.32. Units shall comply with National Electric Code and be UL listed.
- B. Unit shall include chassis, coil, 1-1/2 pound density glass fiber, neoprene spray-coated acoustic and thermal insulation, air blockoffs around coil, fan board/drain pan assembly, fan wheel and housing, motor, junction box and filter. Chassis shall be galvanized steel. Drain pan shall be 18 gauge galvanized fully insulated and trapped. A 7/8 inch ID drain line shall connect drain pan to main drain riser.
- C. All panels shall be cleaned, bonderdized, phosphatized, and painted with light grey baked-on enamel finish as standard.
- D. Fan assembly shall be mounted on slide rail channels for complete access to drain pan area, fan and motor.
- E. Fans shall be galvanized steel fan wheels, centrifugal, forward-curved, double-width, double-inlet. Galvanized steel fan housings.
- F. All motors shall have integral thermal overload protection and shall start at 78 percent of rated voltage. Motors shall operate satisfactorily at 90 percent of rated voltage on all speed settings and at 10 percent overvoltage without undue magnetic noise. Temperature rise by winding resistance method shall not exceed 50 C (PSC) on high speed, and 55 C (PSC) on reduced speeds. Motor shall have easily detachable quick-disconnect plug.
- G. All motors shall be factory run and tested in assembled unit prior to shipping.
- H. All internal wiring shall be by manufacturer. All electric devices including unit-mounted thermostats, motor, speed control switches and electrical heating coils shall be prewired to junction box.
- I. Five-eighth-inch OD seamless copper tubes mechanically bonded to configured aluminum fins with continuous fin collars and sleeved coil end supports. Maximum working pressure 350 psig, factory burst test 450 psi (air) and leak tested 350 psi (air under water). Maximum entering water 275 F. Coils have female sweat connections to accept 5/8 inch OD copper tubing. Coils shall have 168 fins per foot. Manual air vents shall be provided that have a working pressure of 450 psi.
- J. Three-eighth-inch OD copper tubes mechanically bonded to configured aluminum fins with continuous fin collars and sleeved end supports. Maximum working pressure 300 psig. Maximum entering water 220 F. Female sweat connections accept 1/2 inch OD copper tubing. Manual air vents shall be provided. Coils shall have 168 fins per foot.
- K. Piping package shall include three-way, two-position electric control valves for heating coils and three-way two-position for cooling coils. Ball valves, balancing valves. Maximum working pressure for piping packages shall be 300 psig.

- L. Filters shall be concealed from sight, directly behind air inlet grille. Throwaway type filters.

SECTION 15800

PUMPS

- 800.1 Furnish and install pumps with capacities as shown on drawings. Pumps shall be base-mounted, single stage, vertical split case design, capable of being services without disturbing piping connections or motor. Pumps shall be especially designed for hydronic systems. Converted industrial pumps not acceptable.
- 800.2 Pump volute shall be of close-grained cast iron with integrally cast pedestal support. The impeller shall be cast bronze, enclosed type, hydraulically and dynamically balanced, keyed to the shaft and secured by a locking capscrew.
- 800.3 Chilled water pumps shall have drain pan under pump casing, piped to nearest drain. Selections shall be at or near mid-point of pump curve, not to exceed 25 percent of such mid-point, and shall not overload motor up to 150 percent of specified flow rate.
- 800.4 The liquid cavity shall be sealed off at the pump shaft by a mechanical seal with ceramic seal seat and carbon seal ring, suitable for continuous operation at 225°F., or intermittent operation at 250°F. A replaceable shaft sleeve of aluminum bronze alloy shall completely cover the wetted area under the seal.
- 800.5 Pumps shall be rated for minimum of 175 psi working pressure. Casings shall have gauge ports at nozzles, vent and drain ports at top and bottom of casing, and shall be fitted with manual priming vent.
- 800.6 Pump's bearing assembly shall have heavy-duty regreasable ball bearings, replaceable without disturbing piping connections or motor, and have foot support at coupling end.
- 800.7 Base plate shall be heavy structural steel, fully enclosed at sides and ends, with securely welded cross members and open grouting area. Contractor to level and grout each unit as per manufacturer's instructions.
- 800.8 The motor shall meet NEMA specifications and shall be the size, voltage and enclosure called for on the drawings. Pump and motor shall be factory aligned, and shall be re-aligned by contractor after installation. Motors shall be the High Efficiency type.
- 800.9 Each unit shall be checked by the contractor and regulated for proper differential pressure, voltage and amperage draw. This data shall be noted on a permanent tag or label and fastened to pump for Owner's reference.
- 800.10 Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high grade machinery enamel prior to shipment.
- 800.11 Furnish and install DDC control system.
- 800.12.1 Furnish frequency drive with all pumps.
- 800.13 Provide pumps equal to Aurora, B&G or Taco.

SECTION 15815

SPIRAL DUCT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-15 Basic Mechanical Materials and Methods Sections apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of spiral round and flat oval duct and welded round and flat oval duct is indicated on drawings and in schedules, and by requirements of this section.
- B. Refer to other Division-15 sections for exterior insulation of metal ductwork; not work of this section.
- C. Refer to other Division-15 sections for ductwork accessories; not work of this section.
- D. Refer to other Division-15 sections for fans and air handling units; not work of this section.
- E. Refer to other Division-15 sections for testing, adjusting, and balancing of metal ductwork systems; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Manufacturers shall be members of Spiral Duct Manufacturers Association (SPIDA) in accordance with Sheetmetal & Air Conditioning Contractors National Association (SMACNA) Standards.
 - 2. Manufacturer shall be able to internally produce, and will provide, in *.DWG format, piece marked CAD generated piece marked field assembly drawings showing fittings, sizes, pressure class and configuration of ductwork. Coordination with other trades is not to be performed by the manufacturer.
 - 3. Manufacturer will have at least 10 years' experience in the manufacture of single wall and dual wall, round and oval, spiral pipe, welded duct and fittings. Manufacturer's primary business will be the manufacture of spiral pipe and fittings.
 - 4. All spiral pipe and fittings will be manufactured by the same firm.
 - 5. Contractor fabricated duct for this section will not be acceptable.
 - 6. Acceptable manufacturers are; Eastern Sheet Metal, Dixie Sheet Metal, or Lindab.

B. Installer's Qualifications:

1. Contractor with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.
2. Contractor will be able to send, in *.DWG format, coordinated drawings to the duct manufacturer for production of piece marked field assembly drawings showing fittings, sizes, pressure class and configuration of ductwork.

1.4 CODES AND STANDARDS

- A. SMACNA Standards: Comply with 1995 SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
- B. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems".
- C. Field Reference Manual: Have available for reference at project field office, copy of 1995 SMACNA "HVAC Duct Construction Standards, Metal and Flexible" and Eastern Sheet Metal "Product Guide".

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's general product data and installation instructions for spiral round and flat oval ductwork materials and products. Manufacturer shall submit CAD generated, in *.DWG format, piece marked field assembly drawings showing fittings, sizes, gauges and configuration of ductwork prior to fabrication.
- B. Record Drawings: At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Division 1. Contractor will combine drawings from the round and oval duct manufacturer with the as built drawings prepared by the contractor.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Minimize end damage and prevent dirt and moisture from entering ducts and fittings.
- B. Storage: Store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 DUCKWORK MATERIALS

- A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, dents, and other imperfections, including those which would impair painting. Where painting is indicated on drawings, material shall be G-60 galvanized steel suitable for field painting without further treating other than removal of fabrication lubricants and any dirt or debris that may have accumulated on the duct during fabrication, shipping, handling, storage or installation.
- B. Galvanized Ductwork: Standard round and flat oval ductwork shall be fabricated with galvanized sheetmetal (ASTM A653) with G-60 coating of lock forming quality.
- C. Dual Wall Galvanized Ductwork: Where indicated round and flat oval duct shall be fabricated with an exterior pressure shell of galvanized sheet metal with minimum G-60 coating of lock forming quality. The inner shell for pipe will be perforated galvanized steel with 3/32" holes on 3/16" staggered centers. The inner shell for fittings will be perforated galvanized steel. The manufacturer of the dual wall duct will have published sound data.

2.2 INSULATION MATERIALS

- A. Dual Wall Round and Oval Ductwork. Provide the following as indicated:
 - 1. 1" thick, 1.5 lb density fiberglass "duct liner" with an anti-microbial mat facing and a thermal conductivity of .24 per ASTM C177

2.3 FABRICATION

- A. Fabricate round and Flat Oval Ductwork in 10 or 12 feet lengths, unless otherwise indicated or required to complete runs as shown on approved shop drawings. Color code and piece mark each piece for assembly and coordinated installation.
- B. Fittings: Provide radius type elbow fittings fabricated of multiple sections with maximum 22 1/2 degree change of direction per section. Die stamped elbows are required through 12 inch diameter for galvanized systems. Unless specifically detailed otherwise, use radius entrance tees, 45 degree laterals and 45 degree elbows, or 90 degree conical type fittings for branch connections.
- C. Sides of reducers may not have a slope of more than 30 degrees. .
- D. Round Connections:
 - 1. Slip connections will be used up to 19" diameter. Dual wall duct will have concentric sleeve connections to assure proper alignment of the inner wall.

2. Flange connections will be used on all single wall duct larger than 19" diameter and all dual wall duct 12" and larger. Flanges will be a T25a or T25b profile, such as Eastern Flanges as manufactured by Eastern Sheet Metal. Flanges may be screwed or tack welded to the duct wall. Flanges must be factory sealed internally and externally. Dual wall duct will have concentric flange connections such that no other inner connection is required. The outer flange will be attached to the outer pressure shell and sealed. The inner flange will attach to the inner shell and the outer flange, holding the inner wall concentric. A single flange attached to the inner wall is not acceptable.

E. Oval Connections

1. Slip connections will be used up to 19" major axis. Dual wall duct will have concentric sleeve connections to assure proper alignment of the inner wall
2. Flange connections will be used on all single wall duct larger than 24" major axis and all dual wall duct with a minor axis larger than 8". Flanges will be a T25a or T25b profile, such as Eastern Flanges as manufactured by Eastern Sheet Metal. Flanges may be screwed or tack welded to the duct wall. Flanges must be factory sealed internally and externally. Dual wall duct will have concentric flange connections such that no other inner connection is required. The outer flange will be attached to the outer pressure shell and sealed. The inner flange will attach to the inner shell and the outer flange, holding the inner wall concentric. A single flange attached to the inner wall is not acceptable.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

- A. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.
- B. Construct and install each duct system for the specific duct pressure classification indicated.
- C. Install round and flat-oval ducts in lengths not less than 12 feet, unless interrupted by fittings.
- D. Install ducts with fewest possible joints.
- E. Install fabricated fittings for changes in directions, changes in size and shape, and connections.
- F. Install couplings tight to duct wall surface with a minimum of projections into duct.
- G. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.
- H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

- J. Conceal ducts from view in finished spaces.
- K. Coordinate layout with suspended ceiling, fire and smoke control dampers, lighting layouts, and similar finished work.
- L. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches.
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire damper, sleeve, and firestopping sealant. Fire and smoke dampers are specified in Division 15, Section "Duct Accessories". Firestopping materials and installation methods are specified in Division 7, Section "Firestopping".

3.2 SEAM AND JOINT SEALING

- A. General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Pressure Classification Less Than 4 Inch wg: Transverse joints.
- C. Seal externally insulated ducts before insulation installation.

3.3 HANGING AND SUPPORTING

- A. Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
- C. Support vertical ducts at a maximum interval of 16 feet and at each floor.
- D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

3.4 CONNECTIONS

- A. Connect equipment with flexible connectors according to Division 15 Section "Duct Accessories."
- B. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

3.5 FIELD QUALITY CONTROL

- A. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.
- B. Conduct tests, in presence of Engineer, at static pressures equal to maximum design pressure of system or section being tested. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give two days' advance notice for testing.
- C. Determine leakage from entire system or section of system by relating leakage to surface area of test section.
- D. Maximum Allowable Leakage: Comply with requirements for Leakage Classification 3 for round and flat-oval ducts, Leakage Classification 12 for rectangular ducts in pressure classifications less than and equal to 2-inch wg (both positive and negative pressures), and Leakage Classification 6 for pressure classifications from 2- to 10-inch wg.
- E. Remake leaking joints and retest until leakage is less than maximum allowable.
- F. Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual."

3.6 ADJUSTING

- A. Adjust volume-control dampers in ducts, outlets, and inlets to achieve design airflow.
- B. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for detailed procedures.

3.7 CLEANING

After completing system installation, including outlet fittings and devices, inspect the system. Vacuum ducts before final acceptance to remove dust and debris.

SECTION 15820

VENTILATION SYSTEMS

820.1 EXHAUST

- A. Furnish and install all exhaust fans and intake vents as scheduled on drawings. Fans shall be of the type, size and capacity as scheduled and shall be furnished as hereinafter specified and scheduled.
- B. All fans shall have been statically and dynamically balanced prior to leaving factory. Fans found vibrating noticeably in the field, due to damage in shipment, improper handling, etc., will be removed and replaced at no additional cost to the Owner.
- C. Centrifugal wall exhausters shall be of spun aluminum construction attached to the exterior wall by means of fasteners through a special perimeter flange on the spun body. The motors shall be isolated from the exhaust air stream and be mounted on vibration isolators. Birdscreen shall be provided as an integral part of the body assembly and shall be PVC coated. Each fan shall be provided with a factory mounted and wired disconnect switch and gravity damper. All single phase motors shall have built-in thermal overload protection. Fans shall be Greenheck, Loren Cook, or approved equal.
- D. Roof exhaust fans shall be of the centrifugal, direct driven type. The fan housing shall be constructed of heavy gauge aluminum mounted on a rigid support structure. The shroud shall have a rolled bead and internal structural aluminum backward curved, centrifugal type with a well designed inlet venturi for maximum performance. Wheels shall be dynamically and statically balanced. Motors and centrifugal wheels shall be mounted on vibration isolators. Motors shall be isolated from the exhaust airstream. Air for cooling the motor shall be taken into the motor compartment from a location free from contaminants. Motors shall be readily accessible for maintenance. A disconnect switch shall be factory installed and wired from the fan motor to the disconnect junction box. A conduit chase shall be provided for running electrical wiring through the curb cap into the power compartment. All fans shall bear the AMCA Certified Ratings Performance Seal for both air and sound performance. Fans shall be Model GB as manufactured by Greenheck Fan Corporation or approved equal. Fans shall be installed with a back draft damper, roof curb, disconnect switch and bird screen.

SECTION 15840

AIR TERMINAL UNITS - VARIABLE VOLUME

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single duct terminal units.
 - 1. Variable volume.
 - 2. Constant volume.
- B. Integral heating coils.
 - 1. Hot water.

1.02 RELATED SECTIONS

- A. Section 15510 - Hydronic Piping: Connections to heating coils.
- B. Section 15515 - Hydronic Specialties: Connections to heating coils.
- C. Section 15890 - Ductwork.
- D. Section 15910 - Ductwork Accessories.
- E. Section 15952 - Controls and Instrumentation.
- F. Section 15936 - Air Outlets and Inlets.
- G. Section 16180 - Equipment Wiring Systems: Electrical supply to units.

1.03 REFERENCES

- A. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- B. UL 181 - Factory-Made Air Ducts and Connectors.
- C. NFPA 70 - Electric Duct Heaters.
- D. UL 1995, Heating and Cooling Equipment.
- E. CUL C22.2 No. 236, Heating and Cooling Equipment.
- F. ARI 880 - Air-Conditioning and Refrigeration Institute Standard Rating Conditions for Air Terminals.
- G. ASTM A 527 (Steel Sheet, Zinc Coated Galvanized).
- H. A-A-1419 or F-F-310 Federal specification (filter element, Air conditioning, Viscous-impingement or Dry type, replaceable), Tested per UL 900.

1.04 SUBMITTALS

- A. Submit shop drawings and product data sheets indicating configuration, general assembly, and materials used in fabrication.
- B. Submit product performance data indicating design air flow and minimum static pressure drop.
- C. Submit installation, operation and maintenance documentation.

1.05 QUALIFICATIONS

- A. Manufacturer: The company manufacturing the products specified in this section shall have a minimum of ten years experience producing products of this type.

1.06 WARRANTY

- A. Provide manufacturer's parts warranty for one year from unit start-up or eighteen months from unit shipment, whichever is shorter.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. General
 - 1. Manufacturer shall participate in the ARI Certification program. Unit performance data shall be rated in accordance with ARI Standard 880. The manufacturer shall display the ARI Symbol on all units.
 - 2. Single duct terminal units shall be UL listed as an entire assembly.
- B. Variable Volume Boxes shall be manufactured by Trane or approved equal by Titus or Metal-Aire.

2.02 VAV UNITS

- A. Single duct terminal units.
 - 1. Ceiling mounted primary air control terminal units for connection to a single medium - 1.5-3.0 in. wg. pressure duct of a central air distribution system. Terminal units shall be provided without factory mounted controls. Terminal units shall be provided with integral heating coils.
- B. Identify each terminal unit with clearly marked identification label and airflow indicator. Label shall include unit nominal air flow, maximum factory-set air flow, minimum factory-set air flow, and coil type.

2.03 FABRICATION

- A. Casings: Units shall be completely factory-assembled, manufactured of corrosion

protected steel, and fabricated with a minimum of 18-gauge metal on the high pressure (inlet) side of the terminal unit damper and 22-gauge metal on the low pressure (outlet) side and unit casing.

- B. INSULATION - Foil Faced - The interior surface of unit casing shall be acoustically and thermally lined with a minimum of 1/2 inch, 2.0 lb./cu. ft. density glass fiber with foil facing. The insulation R-Value shall be a minimum of 2.2. The interior foil liner shall isolate the fiberglass insulation from the airstream and allow for cleaning of the terminal unit interior surfaces. Insulation shall meet NFPA-90A, UL 181 and bacteriological standard ASTM C 665.
- C. INSULATION EDGE TREATMENT - All cut edges of insulation shall completely enclosed by metal to arrest cut fibers and prevent erosion into the airstream.
- D. Assembly: Primary air control damper, airflow sensor, fans, controls and heating coil in single cabinet.
- E. Rectangular Supply Air Outlet Connections: Rectangular outlet connections for single duct units shall be slip and drive type.

2.04 PRIMARY AIR CONTROL DAMPER ASSEMBLY

- A. Locate primary air control damper assembly inside unit casing. Construct the damper assembly from extruded aluminum and/or a minimum 20 gauge galvanized steel components. Maximum damper leak rate shall not exceed 1% of damper nominal CFM at 4 inch wg. differential. Shaft of damper to extend outside of VAV box suitable for mounting actuator. Controls Contractor shall furnish and install actuator.
- B. Provide damper assembly with integral flow sensor. Flow sensor shall be provided regardless of control type. Flow sensor shall be a multi-point, averaging, ring or cross type. Bar or single point sensing type is not acceptable.

2.05 HEATING COILS

- A. Hot Water Heating Coil: Coils shall be factory-installed and shall consist of aluminum plated fins and seamless copper tubes. Fins shall have full fin collars to provide accurate fin spacing and maximum fin-to-tube contact. Tubes shall be mechanically expanded into the fin collars. Coils shall be leak tested under water to 450 psig pressure. Supply and return water connections shall be on the same side of the coil. Provide coils in capacities as scheduled on the drawings.

2.06 WIRING

- A. Control Transformer - Provide single duct terminal units with a factory installed and wired 24 VAC transformer to provide control voltage power to the unit.

2.07 TESTING / VERIFICATION

- A. Maximum Casing Leakage: 1 percent of nominal air flow at 0.5 in wg inlet static pressure.
- B. Maximum Damper Leakage: 1 percent of design air flow at 4 in wg inlet static pressure.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.02 ADJUSTING

- A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design air flow to 25 percent nominal air flow for cooling only units and 30 percent for units with heating coils.

SECTION 15860

AIR DISTRIBUTION SYSTEM

860.1 SHEET METAL WORK

- A. Furnish and install in an approved manner all ducts and sheet metal work shown on drawings, specified or required to accomplish the intention of these specifications.
- B. Mechanical Contractor shall make all field measurements and shop drawings necessary for fabrication and erection from the Contract drawings and specifications as may be necessitated by job conditions or otherwise. ALL DUCT SIZES SHOWN ARE NET INTERIOR DIMENSIONS AFTER INSULATION.
- C. All sheet metal work shall be constructed and installed in accordance with "SMACNA", "Low Pressure Duct Construction Standards"-1985. Sizes indicated on the drawings are inside to inside sizes, and allowances should be made for the liner. The weights of the sheetmetal ducts and stiffeners shall be as follows:

<u>LONG SIDE</u>	<u>GAUGE</u>	<u>TRANSVERSE JOINT</u>
0 thru 12"	26	S Slip Top Bottom, Drive Cleat on Sides.
13' thru 18"	24	S Slip Top and Bottom, Drive Cleat on Sides.
19" thru 30"	24	Standing S Slip Top and Bottom Drive Cleat on Sides.
31" thru 42"	22	1" Standing S Slip Top and Bottom. Drive Cleat on Sides.
43" thru 60"	22	1 1/2" Standing S Slip Top and Bottom, Drive Cleat on Sides.

- D. Where duct work is to be fastened to the intake or discharge of a fan, install sound insulating flexible connections - at least 4" long - of VENTGLAS Neoprene -coated glass fabric as furnished by Ventfabrics, Inc. At least 1" slack shall be allowed in these connections to insure that no vibration is transmitted from fan to duct work. The fabric shall either be folded in with metal or attached with metal collar frames at each end to prevent air leakage.
- E. Wherever sheet metal work or piping under this Contract passes through exposed wall or roofs, flashing and counterflashing necessary to make the joint between the sheet or piping and the building watertight shall be furnished by the Mechanical Contractor. Flashing and counterflashing shall be 16 ounce sheet copper securely soldered and fitted. Flashing shall be turned out at least 10" all around on the roof and up at least 10" on the duct or pipe.
- F. Manual dampers shall be at least two (2) gauges heavier than the duct in which they are installed and shall be sufficiently rigid to prevent chattering or buckling. Dampers shall be fitted with Ventline #555 quadrants and 3/8" square rods for ducts up to and including 16", and 1/2" rod with Ventline #560 quadrants for larger ducts. Install Ventlok #560 quadrants for larger ducts. Install Ventlok #688 regulators where required to permit operation of

dampers above inaccessible ceilings.

- G. Access doors used for occasional repairs or adjustments of fire dampers in ducts shall be 1" insulated hinged, double cam models, minimum size 16" x 16"; with glass see-through section, similar to Pyro/Gard model by Safe Air, Inc. All units shall be of 22 gauge galvanized sheetmetal with 1" fiberglass insulation, on supply and return ductwork, polyurethane gaskets, and zinc plated sash locks. Provide access doors, sized and located for maintenance work, upstream where possible, in the following locations:
- 1) Each fire damper (for link service), smoke damper and automatic control damper.
 - 2) Each duct mounted smoke detector.
- H. Provide turning vanes in each mitered turn greater than 40 degrees in all rectangular supply, return, OSA, and exhaust ductwork, and at other locations indicated. Turning vanes shall be galvanized steel at least 2 gauges heavier than the gauges of the adjacent ductwork, with 4" minimum radius of curvature, 4" maximum spacing, and not less than 2 vanes in each turning vane installation.
- I. All rectangular branch connections to rectangular ducts shall be a radius type with a centerline radius of 1-1/2 times the branch duct dimension in the plane of the turn with externally adjustable factory fabricated air turning vane assembly and opposed blade rectangular volume damper. All round branch connections to supply rectangular ducts shall be shop fabricated lateral type with butterfly volume damper, similar to Mitchel Metal Products. Return and exhaust run-outs shall be spin-in adapters with volume dampers.
- J. Mechanical Contractor shall guarantee that under all conditions of operation all duct work shall be free of all vibration, chatter, or objectionable pulsations. All ducts in non-conditioned spaces shall be reasonably airtight; the maximum allowable leakage shall be 5% on low pressure ducts. After the system is put into operation, the Mechanical Contractor shall assist the TAB Contractor in balancing the system, making such adjustments as are necessary to obtain specified air quantities. After the system has been balanced to obtain specified air quantities, make such further adjustments, as may be reasonably expected, for even temperatures, as directed by the Engineer. Contractor shall seal all low pressure ductwork during and after installation as recommended by SMACNA for 2" w.g. pressure classification.
- K. Round ductwork joints shall include minimum four sheet metal screws and 2 wraps of 2" wide cloth-backed duct tape.
- L. Maximum 5'-0" flex duct allowed with no bends or sags on downside of VAV boxes.
Maximum 3'-0" high pressure flex duct allow with no bends or sags on upside of VAV boxes.

860.2 DUCT INSULATION

- A. All low velocity rectangular supply, return and outside air duct shall be insulated by lining the inside with 1" thick, 1-1/2 PCF duct liner with an NRC of not less than .70 based on a No.6 mounting, a "K" factor not to exceed .26 at 75°F. mean temperature and shall meet NFPA 90A Standards. The lining shall be secured to the interior surfaces by adhesive and metal clips spaced not less than one clip per two square feet of duct surface. All joints between sections of lining and all longitudinal joints shall be sealed with a fire resistive sealer. ALL

DUCT SIZES SHOWN ON DRAWINGS ARE CLEAR INSIDE DIMENSIONS AFTER INSULATION HAS BEEN INSTALLED.

- B. All round low velocity duct shall be wrapped on the outside with 2" thick duct wrap with FSK facing. The "K" factor at 75°F. mean temperature shall not exceed .31 and shall meet NFPA 90A Standards. Insulation shall be applied by experienced insulation applicators in strict accordance with the manufacturer's printed instructions. All longitudinal and circumferential insulation seams shall be sealed with aluminum metallic tape.
- C. The insulation shall be applied by experienced insulation applicators and all work shall be performed in a neat and workmanlike manner.
- D. Where externally insulated ducts pass through non fire-rated walls, insulation is to be continuous through the wall penetration with proper clearance to keep from compressing insulation.

860.3 SPIRAL DUCTWORK

1.1 RELATED DOCUMENTS

- B. Drawings and general provisions of Contract, including General and Supplementary conditions and Division-1 Specification sections, apply to work of this section.
- C. Division-15 Basic Mechanical Materials and Methods Sections apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of spiral round and flat oval duct and welded round and flat oval duct is indicated on drawings and in schedules, and by requirements of this section.
- B. Refer to other Division-15 sections for exterior insulation of metal ductwork; not work of this section.
- D. Refer to other Division-15 sections for ductwork accessories; not work of this section.
- E. Refer to other Division-15 sections for fans and air handling units; not work of this section.
- F. Refer to other Division-17 sections for testing, adjusting, and balancing of metal ductwork systems; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Manufacturers shall be members of Spiral Duct Manufacturers Association (SPIDA) in accordance with Sheetmetal & Air Conditioning Contractors National Association (SMACNA) Standards.
 - 1. Manufacturer shall be able to internally produce, and will provide, in *.DWG format, piece marked CAD generated piece marked field assembly drawings showing fittings, sizes,

pressure class and configuration of ductwork. Coordination with other trades is not to be performed by the manufacturer.

2. Manufacturer will have at least 10 years experience in the manufacture of single wall and dual wall, round and oval, spiral pipe, welded duct and fittings. Manufacturer's primary business will be the manufacture of spiral pipe and fittings.
3. All spiral pipe and fittings will be manufactured by the same firm.
4. Contractor fabricated duct for this section will not be acceptable.
5. Acceptable manufacturers are; Eastern Sheet Metal or Lindab.

B. Installer's Qualifications:

1. Contractor with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.
2. Contractor will be able to send, in *.DWG format, coordinated drawings to the duct manufacturer for production of piece marked field assembly drawings showing fittings, sizes, pressure class and configuration of ductwork.

1.6 CODES AND STANDARDS

- G. SMACNA Standards: Comply with 1995 SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
- H. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems".
- I. Field Reference Manual: Have available for reference at project field office, copy of 1995 SMACNA "HVAC Duct Construction Standards, Metal and Flexible" and Eastern Sheet Metal "Product Guide".

1.7 SUBMITTALS

- A. Product Data: Submit manufacturer's general product data and installation instructions for spiral round and flat oval ductwork materials and products. Manufacturer shall submit CAD generated, in *.DWG format, piece marked field assembly drawings showing fittings, sizes, gauges and configuration of ductwork prior to fabrication.
- B. Record Drawings: At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Division 1. Contractor will combine drawings from the round and oval duct manufacturer with the as built drawings prepared by the contractor.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Minimize end damage and prevent dirt and moisture from entering ducts and fittings.
- B. Storage: Store ductwork inside and protect from weather.

PART 4 - PRODUCTS

2.4 DUCKWORK MATERIALS

- A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, dents, and other imperfections, including those which would impair painting. Where painting is indicated on drawings, material shall be G-60 galvanized steel suitable for field painting without further treating other than removal of fabrication lubricants and any dirt or debris that may have accumulated on the duct during fabrication, shipping, handling, storage or installation.
- B. Galvanized Ductwork: Standard round and flat oval ductwork shall be fabricated with galvanized sheetmetal (ASTM A653) with G-60 coating of lock forming quality.
- C. Dual Wall Galvanized Ductwork: Where indicated round and flat oval duct shall be fabricated with an exterior pressure shell of galvanized sheet metal with minimum G-60 coating of lock forming quality. The inner shell for pipe will be perforated galvanized steel with 3/32" holes on 3/16" staggered centers. The inner shell for fittings will be solid galvanized steel. The manufacturer of the dual wall duct will have published sound data.
- D. Aluminum Ductwork: Where indicated, provide aluminum sheet complying with ASTM B209; Alloy 3003, Temper H14.

2.5 INSULATION MATERIALS

- A. Dual Wall Round and Oval Ductwork. Provide the following as indicated on plans:
- B. 1" thick, 1.5 lb density fiberglass "duct liner" with an anti-microbial mat facing and a thermal conductivity of .24 per ASTM C177.

2.6 FABRICATION

- A. Fabricate round and Flat Oval Ductwork in 10 or 12 feet lengths, unless otherwise indicated or required to complete runs as shown on approved shop drawings. Color code and piece mark each piece for assembly and coordinated installation.
- B. Fittings: Provide radius type elbow fittings fabricated of multiple sections with maximum 22 1/2 degree change of direction per section. Die stamped elbows are required through 12 inch diameter for galvanized systems. Unless specifically detailed otherwise, use full bodied fitting with radius entrance tees, 45 degree laterals and 45 degree elbows. Where shown 90 degree conical type fittings for branch connections shall be factory installed and fully welded.
- C. Sides of reducers may not have a slope of more than 30 degrees. .
- D. Round Connections:
 - 1. Slip connections will be used up to 19" diameter. Dual wall duct will have concentric sleeve connections to assure proper alignment of the inner wall.

2. Flange connections will be used on all single wall duct larger than 19" diameter and all dual wall duct 12" and larger. Flanges will be a T25a or T25b profile, such as Eastern Flanges as manufactured by Eastern Sheet Metal. Flanges may be screwed or tack welded to the duct wall. Flanges must be factory sealed internally and externally. Dual wall duct will have concentric flange connections such that no other inner connection is required. The outer flange will be attached to the outer pressure shell and sealed. The inner flange will attach to the inner shell and the outer flange, holding the inner wall concentric. A single flange attached to the inner wall is not acceptable.

E. Oval Connections

1. Slip connections will be used up to 19" major axis. Dual wall duct will have concentric sleeve connections to assure proper alignment of the inner wall.
2. Flange connections will be used on all single wall duct larger than 24" major axis and all dual wall duct with a minor axis larger than 8". Flanges will be a T25a or T25b profile, such as Eastern Flanges as manufactured by Eastern Sheet Metal. Flanges may be screwed or tack welded to the duct wall. Flanges must be factory sealed internally and externally. Dual wall duct will have concentric flange connections such that no other inner connection is required. The outer flange will be attached to the outer pressure shell and sealed. The inner flange will attach to the inner shell and the outer flange, holding the inner wall concentric. A single flange attached to the inner wall is not acceptable.

F. Fabricate Ductwork of gages and reinforcement complying with SMACNA "HVAC Duct Construction Standards", 1995 edition, and published literature of Eastern Sheet Metal, for the appropriate pressure class as follows;

1. Supply duct to be fabricated for 10" WG positive pressure.
2. Exhaust duct to be fabricated for 4" WG negative pressure.
3. All exhaust duct will have appropriate reinforcement factory installed.
4. All stainless steel duct to be continuously welded minimum 20 gauge. Spiral stainless steel pipe will not be acceptable.
5. All fittings, except poly coated fittings, will be continuously welded 20 gauge minimum. Tack welding will not be acceptable.

PART 5 - EXECUTION

3.8 DUCT INSTALLATION, GENERAL

- A. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.
- B. Construct and install each duct system for the specific duct pressure classification indicated.
- C. Install round and flat-oval ducts in lengths not less than 12 feet unless interrupted by fittings.

- D. Install ducts with fewest possible joints.
- E. Install fabricated fittings for changes in directions, changes in size and shape, and connections.
- F. Install couplings tight to duct wall surface with a minimum of projections into duct.
- G. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.
- H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- J. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.
- K. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- L. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches.
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire damper, sleeve, and firestopping sealant. Fire and smoke dampers are specified in Division 15 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Firestopping."

3.9 SEAM AND JOINT SEALING

- A. General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Pressure Classification Less Than 2-Inch wg: Transverse joints.
- C. Seal externally insulated ducts before insulation installation.

3.10 HANGING AND SUPPORTING

- A. Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

- C. Support vertical ducts at a maximum interval of 16 feet and at each floor.
- D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- E. Install concrete inserts before placing concrete.
- F. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3.11 CONNECTIONS

- C. Connect equipment with flexible connectors according to Division 15 Section "Duct Accessories."
- D. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

3.12 FIELD QUALITY CONTROL

- A. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.
- B. Conduct tests, in presence of Engineer, at static pressures equal to maximum design pressure of system or section being tested. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
- C. Determine leakage from entire system or section of system by relating leakage to surface area of test section.
- D. Maximum Allowable Leakage: Comply with requirements for Leakage Classification 3 for round and flat-oval ducts, Leakage Classification 12 for rectangular ducts in pressure classifications less than and equal to 2-inch wg (both positive and negative pressures), and Leakage Classification 6 for pressure classifications from 2- to 10-inch wg.
- E. Remake leaking joints and retest until leakage is less than maximum allowable.
- F. Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual."

3.13 ADJUSTING

- A. Adjust volume-control dampers in ducts, outlets, and inlets to achieve design airflow.
- B. Refer to Division 17 Section "Testing, Adjusting, and Balancing" for detailed procedures.

3.14 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect the system. Vacuum ducts before final acceptance to remove dust and debris.

860.3 GRILLES, REGISTERS AND DIFFUSERS

- A. Grilles, registers and diffusers shall be factory-fabricated of aluminum and steel and shall distribute the specified quantity of air evenly over space intended, without causing noticeable drafts. Provide opposed blade damper and air extractors for each supply grille. The inlets and outlets shall be sound rated and certified in accordance with Air Diffusion Council Equipment Test Code Standard 1062R3, in sound power level, decibels reference 10-12 watt, in octave bands 2 through 8. All supply and exhaust devices shall include integral volume damper.
- B. Contractor shall utilize a rigid sheet metal elbow above extended neck of all air distribution devices at all ceiling grilles, registers and diffusers.

SECTION 15900

ENERGY MANAGEMENT AND TEMPERATURE CONTROL SYSTEM

THIS CONTRACTOR SHALL INCLUDE IN THEIR QUOTE AN ALLOWANCE OF \$191,000.00 FOR SECTION 15900.

A REQUEST FOR PROPOSAL WILL BE ISSUED BY THE PROFESSIONAL FOR THE PROJECT HVAC INSTRUMENTATION AND CONTROL AS SPECIFIED IN DIVISION 15 AND SHOWN ON DRAWINGS. THE SEALED PROPOSAL WILL BE SUBMITTED TO THE PROFESSIONAL WHO WILL REVIEW THEM, THEN MAKE A RECOMMENDATION TO THE OWNER

AN ALLOWANCE OF INCLUSION IN THE CONTRACT SUM HAS BEEN SPECIFIED IN DIVISION ONE SUPPLEMENT, SECTION 01900, "PART 2 – ALLOWANCE SUPPLEMENT" FOR PURCHASE OF THE BUILDING AUTOMATION SYSTEMS AND CONTROLS.

PART 1: GENERAL

1.0 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Division 15 - Hydronic Piping:
 - 1. Control Valves
 - 2. Flow Switches
 - 3. Temperature Sensor Wells and Sockets
 - 4. Flow Meters
- B. Division 15 - Ductwork Accessories:
 - 1. Automatic Dampers
 - 2. Airflow Stations
 - 3. Terminal Unit Controls

1.1 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THIS SECTION

- A. Division 15 – Heat Generation Equipment
 - 1. Boilers
- B. Division 15 - Refrigeration Equipment
 - 1. Chillers
- C. Division 15 – Variable Frequency Drives
 - 1. Pumps

1.2 RELATED SECTIONS

- A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are a part of these Specifications and shall be used in conjunction with this

Section as a part of the Contract Documents. Consult them for further instructions pertaining to this work. The Contractor is bound by the provisions of Division 0 and Division 1.

1.3 DESCRIPTION

- A. The Building Automation System (EMCS) manufacturer shall furnish and install a fully integrated building automation system to integrate seamlessly with the existing Campus Trane Summit Energy management System. The building system shall incorporate direct digital control (DDC) for energy management equipment monitoring and control, and subsystems with open communications capabilities as herein specified.
- B. Personal computer operator workstations shall be provided for command entry, information management, network alarm management and database management functions. All real-time control functions shall be resident in the DDC Controllers to facilitate greater fault tolerance and reliability.
 - 1. Provide one (1) workstation located at the Physical Plant Office to replace existing.
 - 2. Workstation shall consist of an 19" LCD color monitor, personal computer with minimum 3 GIG RAM, 80.0 GB hard drive and controller, 3-1/2" diskette drive, 8X DVD RW drive, mouse and 101-key enhanced keyboard. Personal computer shall be an IBM compatible PC and shall include a minimum 1.6 GHZ Pentium processor.
 - 3. The minimum display resolution of no less than 1024 x768 pixels. Separate controls shall be provided for color, contrasts and brightness. The screen shall be non-reflective.
- C. General - The control system shall be as indicated on the drawings and described in the specifications, and consist of a peer-to-peer network of digital building control panels and operator workstation(s). The operator workstation shall be a personal computer (PC) including a color monitor, mouse and keyboard. The PC shall provide users an interface with the system though dynamic color graphics of building areas and systems.
- D. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of systems defined for control on this project.
- E. The control system shall accommodate simultaneous multiple user operation. Access to the control system data should be limited by operator password. An operator shall be able to log onto any workstation of the control system and have access to all designated data.
- F. The control system shall be designed such that each mechanical system will operate under stand-alone control. As such, in the event of a network communication failure, or the loss of other controllers, the control system shall continue to independently operate the unaffected equipment.
- G. Communication between the control panels and all workstations shall be over a high-speed network. All nodes on this network shall be peers. A modem or network communications card shall be provided to for remote access to the system.
- H. Controls Contractor shall furnish and install new smoke detectors in each air handling unit and each new rooftop unit. Controls contractor shall interlock new smoke detectors with building fire alarm system.

1.4 APPROVED CONTROL SYSTEM CONTRACTORS AND MANUFACTURERS

A. Approved Control System Contractors and Manufacturers:

Manufacturer Name	Product Line		
Trane	Tracer Summit		
Siemens	Apogee		

1. The above list of manufacturers applies to operator workstation software, controller software, the custom application programming language, *Building Controllers*, *Custom Application Controllers*, and *Application Specific Controllers*. All other products specified herein (i.e., sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

1.5 QUALITY ASSURANCE

A. System Installer Qualifications

1. The Installer shall have an established working relationship with the Control System Manufacturer of not less than five years.
2. The Installer shall have successfully completed Control System Manufacturer's classes on the control system. The Installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request.
3. The installer shall have an office within 150 miles of the project site and provide 8-hour response in the event of a customer call.

1.6 CODES AND STANDARDS

A. Work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of local, state and federal authorities. As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids of the following codes:

1. National Electric Code (NEC)
2. International Building Code (IBC)
3. International Mechanical Code (IMC)
4. Underwriters Laboratories: Products shall be UL-916-PAZX listed.
5. ANSI/ASHRAE Standard 135-2004 (BACnet)
6. ANSI/EIA/CEA-709.1 (LonTalk)

1.7 SYSTEM PERFORMANCE

A. Performance Standards - The system shall conform to the following:

1. Graphic Display - The system shall display a graphic with a minimum of 20 dynamic points with current data displayed within 20 seconds of the request.

2. Graphic Refresh - The system shall update all dynamic points with current data within 30 seconds.
3. Object Command - The maximum time between the command of a binary object by the operator and the reaction by the device shall be 10 seconds. Analog objects shall start to adjust within 10 seconds.
4. Object Scan - All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current, within the prior 60 seconds.
5. Alarm Response Time - The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 45 seconds.
6. Program Execution Frequency - Custom and standard applications shall be capable of running as often as once every 5 seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
7. Performance - Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every 5 seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
8. Multiple Alarm Annunciation - All workstations on the network shall receive alarms within 5 seconds of each other.
9. Reporting Accuracy - Table 1 lists minimum acceptable reporting accuracy for all values reported by the specified system.

Table 1
Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±0.5°C [±1°F]
Ducted Air	±1.0°C [±2°F]
Outside Air	±1.0°C [±2°F]
Water Temperature	±0.5°C [±1°F]
Delta-T	±0.15°C [±0.25°F]
Relative Humidity	±2% RH
Water Flow	±5% of full scale
Air Flow (terminal)	±10% of reading *Note 1
Air Flow (measuring stations)	±5% of reading
Air Pressure (ducts)	±25 Pa [±0.1 "W.G.]
Air Pressure (space)	±3 Pa [±0.01 "W.G.]
Water Pressure	±2% of full scale *Note 2
Carbon Monoxide (CO)	± 5% of reading
Carbon Monoxide (CO2)	± 50 PPM

Note 1: 10%-100% of scale

Note 2: For both absolute and differential pressure

1.8 SUBMITTALS

- A. Contractor shall provide shop drawings and manufacturers' standard specification data sheets on all hardware and software to be provided. No work may begin on any segment of this project until the Engineer and Owner have reviewed submittals for conformity with the plan and specifications. Eight (8) copies are required. All shop drawings shall be provided to the Engineer electronically as .dwg or .dxf file formats.
- B. Quantities of items submitted shall be reviewed by the Engineer and Owner. Such review shall not relieve the contractor from furnishing quantities required for completion.
- C. Provide the Engineer and Owner, any additional information or data which is deemed necessary to determine compliance with these specifications or which is deemed valuable in documenting the system to be installed.
- D. Submit the following within 60 business days of contract award:
 - 1. A complete bill of materials of equipment to be used indicating quantity, manufacturer and model number.
 - 2. A schedule of all control valves including the valve size, model number (including pattern and connections), flow, CV, pressure rating, and location.
 - 3. A schedule of all control dampers. This shall include the damper size, pressure drop, manufacturer and model number.
 - 4. Provide manufacturers cut sheets for major system components. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is being submitted to cover. Include:
 - a) Building Controllers
 - b) Custom Application Controllers
 - c) Application Specific Controllers
 - d) Operator Interface Computer(s)
 - e) Auxiliary Control Devices
 - f) Duct Smoke Detectors
 - g) Proposed control system riser diagram showing system configuration, device locations, addresses, and cabling
 - h) Detailed termination drawings showing all required field and factory terminations. Terminal numbers shall be clearly labeled
 - i) Points list showing all system objects, and the proposed English language object names
 - j) Sequence of operations for each system under control. This sequence shall be specific for the use of the Control System being provided for this project
 - k) Provide a BACnet Product Implementation Conformance Statement (PICS) for each BACnet device type in the submittal
 - l) Color prints of proposed graphics with a list of points for display
- E. Project Record Documents - Upon completion of installation submit four (4) copies of as-built documents. The documents shall be submitted for approval prior to final completion and include:

1. Project Record Drawings - These shall be as-built versions of the submittal shop drawings. One set of electronic media including CAD .DWG or .DXF drawing files shall also be provided.
2. Testing and Balancing Reports and Checklists.
3. Operating and Maintenance (O & M) Manual - These shall be as-built versions of the submittal product data. In addition to that required for the submittals, the O & M manual shall include:
 - a) Names, address and 24-hour telephone numbers of Contractors installing equipment, and the control systems and service representative of each.
 - b) Operators Manual with procedures of operating the control systems including logging on/off, alarm handling, producing point reports, trending data, overriding computer control, and changing set points and other variables.
 - c) Programming Manual with a description of the programming language including syntax, statement descriptions including algorithms and calculations used, point database creation and modification, program creation and modification, and use of the editor.
 - d) Engineering, Installation and Maintenance Manual(s) that explains how to design and install new points, panels, and other hardware; preventative maintenance and calibration procedures; how to debug hardware problems; and how to repair or replace hardware.
 - e) A listing and documentation of all custom software created using the programming language including the point database. One set of magnetic media containing files of the software and database shall also be provided.
 - f) One set of electronic media containing files of all color-graphic screens created for the project.
 - g) Complete original issue documentation, installation, and maintenance information for all third party hardware provided including computer equipment and sensors.
 - h) Complete original issue media for all software provided including operating systems, programming language, operator workstation software, and graphics software.
 - i) Licenses and warranty documents for all equipment and systems.
 - j) Recommended preventive maintenance procedures for all system components including a schedule of tasks, time between tasks, and task descriptions.

H. Training Materials - The Contractor shall provide a course outline and training material for all training classes at least six weeks prior to the first class. The Owner reserves the right to modify any or all of the training course outline and training materials. Review and approval by Owner and Engineer shall be completed at least 3 weeks prior to first class.

1.9 WARRANTY

A. Warrant all work as follows:

1. Labor & materials for control system specified shall be warranted free from defects for a period of twelve (12) months after final acceptance of the project by the Owner. Control System failures during the warranty period shall be adjusted, repaired, or replaced at no charge or reduction in service to the Owner. The Contractor shall

respond to the Owner's request for warranty service within 4 hours during customary business hours.

2. Operator workstation software, project specific software, graphics, database, and firmware updates shall be provided to the Owner at no charge during the warranty period. Written authorization by Owner must, however, be granted prior to the installation of such changes.
3. The system provider shall provide a web-accessible system and support on-line resource that provides the Owner access to a question/answer forum, graphics library, user tips, upgrades, and manufacturer training schedules.

1.10 OWNERSHIP OF PROPRIETARY MATERIAL

- A. All project-developed hardware and software shall become the property of the Owner. These items include but are not limited to:
 1. Project graphic images
 2. Record drawings
 3. Project database
 4. Project-specific application programming code
 5. All documentation

PART 2: PRODUCTS

2.0 SECTION INCLUDES

1. Materials
2. Communication
3. Operator Interface
4. Application and Control Software
5. Building Controllers
6. Custom Application Controllers
7. Application Specific Controllers
8. Input/Output Interface
9. Auxiliary Control Devices

2.1 MATERIALS

- A. All products used in this installation shall be new, currently under manufacture, and shall be applied in similar installations for a minimum of 2 years. The installation shall not be used as a test site for any new products unless explicitly approved by the Owner's representative in writing. Spare parts shall be available for at least 5 years after completion of this contract.

2.2 COMMUNICATION

- A. This project shall comprise of a network utilizing high-speed BACnet for communications between Building Controllers and PC workstations. LonTalk sub-networks may be used for communications between Building Controllers, Custom Application Controllers and Application Specific Controllers.

- B. The controls Contractor shall provide all communication media, connectors, repeaters, hubs, and routers necessary for the DDC system internetwork.
- C. The Owner will provide all communication media, connectors, repeaters, hubs, and routers necessary for the internetwork. An active 10BaseT jack will be provided adjacent to each Building Control Panel and PC Workstation for connection to this network. Ethernet connectivity shall be by owner. Locate RJ-45 wall jack within 6 feet of BCU.
- D. All Building Controllers shall have a communications port for connections with the operator interfaces. This may be either a network interface node for connection to the Ethernet network or an RS-232 port for Point to Point connection.
- E. Communications services over the internetwork shall result in operator interface and value passing that is transparent to the internetwork architecture as follows:
 - 1. Connection of an operator interface device to any one building controller on the internetwork will allow the operator to interface with all other building controllers as if that interface were directly connected to the other controllers. Data, status information, reports, system software, custom programs, etc., for all building controllers shall be available for viewing and editing from any one building controller on the internetwork.
 - 2. All database values (i.e., points, software variable, custom program variables) of any one building controller shall be readable by any other building controller on the internetwork. This value passing shall be automatically performed by a controller when a reference to a point name not located in that controller is entered into the controller's database. An operator/installer shall not be required to set up any communications services to perform internetwork value passing.
- F. The time clocks in all controllers shall be automatically synchronized daily.

2.3 OPERATOR INTERFACE

- A. Operator Interface - Furnish one (1) PC based workstation as shown on the system drawings. Each workstation shall be able to access all information in the system. Workstations shall reside on the same high-speed network as the building controllers, and also be able to dial into the system.
- B. Workstation information access shall use the BACnet Protocol. Communication shall use the ISO 8802-3 (Ethernet) Physical/Data Link layer protocol. Remote communications shall use the BACnet Point to Point Physical/Data Link Layer Protocol.
- C. Hardware - Each operator workstation shall consist of the following:
 - 1. Laser Color Printer, 12 ppm.
 - 2. Project shall include a laptop computer to monitor and adjust DDC system. The system furnished shall be as follows or approved equal.

Dell XPS 1330
Intel Core 2 Duo Processor
2 GB DDR2 Memory

160 GB Hard Disk Drive
NVIDIA GeForce 8400 video card
2 – 9 cell lithium batteries
Integrated 10/100 network Ethernet capability
Wireless 802.11 a/g capability
65 watt auto/air/ac adapter
CD/DVD burner drive
Windows XP operating system

B. System Software

1. All computers provided shall include a fully licensed copy of all software necessary to control, operate, edit, create, and backup DDC system. The software shall be provided on CD-ROM or DVD disk. The software shall include printed paper manuals and installation instructions.

A backup copy of all databases, points, programs and graphics shall be included on CD-ROM or DVD disk.

2. Operating System - Furnish a commercially available, concurrent multi-tasking operating system. Acceptable operating systems are Microsoft Windows XP Professional.
3. System Graphics - The Operator Workstation software shall be graphically oriented. The system shall allow display of up to 10 graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while the system is on line. An operator with the proper password level shall be able to add, delete, or change dynamic points on a graphic. Dynamic points shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation of equipment. Animation capabilities shall include the ability to show a sequence of images reflecting the position of analog outputs, such as valve or damper positions. Graphics shall be capable of launching other PC applications.
4. Custom Graphics - Custom graphic files shall be created with the use of commonly available graphics packages such as Corel Paint Shop Pro. The graphics generation package shall create and modify graphics that are saved in industry standard formats such as BMP, GIF and JPEG. Controls Contractor to match existing graphics standards to build new software.
5. Graphics Library - Furnish a complete library of standard HVAC equipment such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators, including 2-dimensional and 3-dimensional graphic depictions. The library shall include a minimum of 300 such files available for use by the Owner. This library shall also include standard graphical representations of equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.
6. Engineering Units - Allow for selection of the desired engineering units (i.e. Inch pound or SI) in the system. Unit selection shall be able to be customized by locality to select the desired units for each measurement. Engineering units on this project shall be Inch

Pound.

- C. System Applications - Each workstation shall provide operator interface and off-line storage of system information. Provide the following applications at each workstation.
1. Automatic System Database Save and Restore - Each workstation shall store on the hard disk a copy of the current database of each building controller. This database shall be updated whenever a change is made in any panel in the system. The storage of this data shall be automatic and not require operator intervention. In the event of a database loss in a building management panel, the first workstation to detect the loss shall automatically restore the database for that panel.
 2. Manual Database Save and Restore - A system operator with the proper password clearance shall be able to archive the database from any system panel and store on magnetic media. The operator shall also be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.
 3. System Configuration - The workstation software shall provide a graphical method of configuring the system. The user with proper security shall be able to add new devices, and assign modems to devices. This shall allow for future system changes or additions.
 4. On-Line Help and Training - Provide a context sensitive, on line help system to assist the operator in operation and editing of the system. On-line help shall be available for all system functions and shall provide the relevant data for that particular screen. Additional help shall be available through the use of hypertext links onscreen.
 5. Security - Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system supervisor shall have the ability to set security levels for all other operators. Each operator password shall be able to restrict the operator's access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto logoff time shall be set per operator password. All system security data shall be stored in an encrypted format.
 6. System Diagnostics - The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
 7. Alarm Notification - Alarm messages shall use full language, easily recognized descriptors for alarm. System shall allow the user to have up to 10 popup windows appear for incoming alarms. The popup dialog shall allow the user to silence and acknowledge alarms, view an expanded message or graphic, and add and save comments for the alarm.
 8. Alarm Processing - Any object in the system shall be configurable to alarm in and out of normal state. The operator shall be able to configure the alarm limits, warning limits, states, and reactions for each object in the system.
 9. Alarm Reactions - The operator shall be able to determine what actions, if any are to be taken, by object, during an alarm. Actions shall include logging, printing, start a custom

control program, displaying messages, dialing out to remote workstations, paging or text message to a cell phone, forwarding to an e-mail address, providing audible annunciation or displaying specific system graphics. Each of these actions shall be configurable by workstation and time of day. An object in alarm that has not been acknowledged within an operator specified time period shall be re-routed to an alternate operator specified alarm receipt device. For text messaging, the system shall support TAP protocol including parities 7-E-1 and 8-n-1, such that if the system fails to dial out/connect with one parity it will automatically try the other one.

10. Alarm and Event Log - The operator shall be able to view all logged system alarms and events from any location in the system. The operator shall be able to sort and filter alarms from events. Alarms shall be sorted in up to 5 color-coded categories based on

Owner preference (V17). Include an alarm count summary for each alarm category on the system toolbar. An operator with the proper security level may acknowledge and clear alarms. All that have not been cleared by the operator shall be archived to the hard disk on the workstation. Provide a comment field in the event log that allows a user to add specific comments associated with any alarm.

11. Trend Logs - The operator shall be able to define a trend log for any data in the system. This definition shall include interval, start-time, and stop-time. Trend intervals of 30 seconds, 1, 5, 15, 30, and 60 minutes as well as once a shift (8 hours), once a day, once a week, and once a month shall be selectable. Each trend shall accommodate up to 64 system objects. The system operator shall be able to determine how many samples are stored in each trend. Trend data shall be sampled and stored on the Building Controller panel and be archived on the workstation hard disk. Trend data shall be able to be viewed and printed from the operator interface software. Trends must be viewable in a text-based format or graphically. Trends shall also be storable in a tab delimited ASCII format for use by other industry standard word processing and spreadsheet packages.

12. Dynamic Graphical Trending - The system shall have the ability to save the data collected by a trend object and display that collected data in a graphical chart. Trend viewing capabilities shall include the ability to show up to 10 points on a chart, to include live and/or historical data. Each data point trend line shall be an individual color, and include on-graph icons that represent associated events/alarms, manual overrides, and automated changes that have occurred over the time frame represented on the chart. Navigation and viewing functions shall include scrolling and zooming of x and y-axes, and a trace display of the associated time stamp, and values for any selected point along the x-axis. Trend data shall be able to be stored for up to 10 years on the PC workstation.

13. Object and Property Status and Control - Provide a method for the operator to view, and edit if applicable, the status of any object and property in the system. These statuses shall be available by menu, on graphics or through custom programs.

14. Clock Synchronization - The real time clocks in all building controllers and workstations shall be synchronized on command of an operator. The system shall also be able to automatically synchronize all system clocks; daily from any operator designated device in the system. The system shall automatically adjust for daylight savings time if applicable.

15. Reports and Logs - Provide a reporting package that allows the operator to select, modify, or create reports. Each report shall be definable as to data content, format, interval, and

date. Report data shall be archived on the hard disk for historical reporting. Provide the ability for the operator to obtain real time logs of designated lists of objects. Reports and logs shall be stored on the PC hard disk in a format that is readily accessible by other standard software applications including spreadsheets and word processing. Reports and logs shall be readily printed to the system printer. The operator shall be able to designate reports that shall be printed or stored to disk at selectable intervals. Provide a means to list and access the last 10 reports viewed by the user.

- a) *Custom Reports* - Provide the capability for the operator to define any system data into a daily, weekly, monthly, or annual report. These reports shall be time and date stamped and shall contain a report title.
- b) *Standard Reports* - The following standard system reports shall be provided for this project. These reports shall be readily customized to the project by the owner.
 - i. *All Points in Alarm Report*: Provide an on demand report showing all current alarms.
 - ii. *All Points in Override Report*: Provide an on demand report showing all overrides in effect.
 - iii. *Schedule Report*: Provide a summary of all schedules including Holiday and Exception schedules.
 - iv. *Commissioning Report*: Provide a one-time report that lists all equipment with the unit configuration and present operation.
 - v. *Weather Data Report*: Provide a monthly report showing the daily minimum, maximum and average outdoor air temperature and the number of heating and cooling degree days for each day. Provide an annual (12 month) report showing the minimum, maximum and average outdoor air temperature for the month and the number of heating and cooling degree days for the month.

D. Workstation Applications Editors - Each PC workstation shall support dedicated screens for editing of all system applications. Provide editors for each application at the PC workstation. The applications shall be downloaded and executed at the appropriate controller panels.

1. Controller - Provide a full screen editor for each type custom application, and application specific controller that shall allow the operator to view and change the configuration, name, control parameters, and system set points.
2. Scheduling - An editor for the scheduling application shall be provided at each workstation. Provide a monthly calendar for each schedule. Exception schedules and holidays shall be shown clearly on the calendar. Provide a method for allowing several related objects to follow a schedule. An advance and delay time for each object shall be adjustable from this master schedule. An operator shall be able to modify the schedule. Schedules shall be able to be easily copied between objects and/or dates.
3. Manual Control and Override - Provide a means of manually controlling analog and binary output points. Control overrides shall be performed through a simple, graphical on-off-auto editor for binary points, and auto-manual selector for analog control. Provide an icon indicator of override status when a point, unit controller or application has been overridden manually.
4. Air System Equipment Coordination - Provide editor screens with monitoring and control functions that group together and coordinates the operation of air handling equipment and associated VAV boxes as specified in the sequence of operations. For each air system, the editor pages shall include:

- a) System mode of the air handling system
 - b) Listing and assignment of the associated air handler and VAV boxes
 - c) AHU supply air cooling and heating setpoints
 - d) AHU minimum, maximum and nominal static pressure setpoints
 - e) VAV box minimum and maximum flow, and drive open and close overrides
5. Chiller System - A chiller plant control application shall be configured using a full screen editor and shall provide operating status for the system. The display shall include:
- a) System mode of the chiller plant
 - b) Chiller enable/disable status
 - c) System supply water setpoint
 - d) System supply and return water temperature
 - e) System chilled water pump status
 - f) System chilled water flow
 - g) Messages as to when an additional chiller will be added or removed from operational sequence
 - h) Chiller or system failure information
 - i) Chiller rotation information
 - j) Override capabilities to force an added chiller, subtract a chiller, or change of sequence.
 - k) Control to remove a chiller from a sequence temporarily for service purposes.
- E. Custom Application Programming - Provide the tools to create, modify, and debug custom application programming. The operator shall be able to create, edit, and download custom programs at the same time that all other system applications are operating. The system shall be fully operable while custom routines are edited, compiled, and downloaded.

2.4 APPLICATION AND CONTROL SOFTWARE

- A. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the operator workstation.
- B. System Security
- 1. User access shall be secured using individual security passwords and user names.
 - 2. Passwords shall restrict the user to only the objects, applications, and system functions as assigned by the system manager.
 - 3. User logon/logoff attempts shall be recorded.
 - 4. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.
- C. Scheduling - Provide the capability to schedule each object or group of objects in the system. Each of these schedules shall include the capability for start, stop, optimal start, optimal stop, and night economizer actions. Each schedule may consist of up to 10 events. When a group of objects are scheduled together, provide the capability to define advances and delays for each member. Each schedule shall consist of the following:
- 1. Weekly Schedule - Provide separate schedules for each day of the week.

2. Exception Schedules - Provide the ability for the operator to designate any day of the year as an exception schedule. This exception schedule shall override the standard schedule for that day. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed it will be discarded and replaced by the standard schedule for that day of the week.
 3. Holiday Schedules - Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.
 4. Optimal Start - The scheduling application outlined above shall support an optimal start algorithm. This shall calculate the thermal characteristics of a zone and start the equipment prior to occupancy to achieve the desired space temperature at the specified occupancy time. The algorithm shall calculate separate sets of heating and cooling rates for zones that have been unoccupied for less than and greater than 24 hours. Provide the ability to modify the start algorithm based on outdoor air temperature. Provide an early start limit in minutes to prevent the system from starting before an operator determined time limit.
- D. Remote Communications - The system shall have the ability to transmit alarms to multiple associated alarm receivers. Receivers shall include PC Workstations, email addresses, cell phones and alphanumeric pagers. The alarm message shall include the name of the alarm location, the device that generated the alarm, and the alarm message itself. The operator shall be able to remotely access and operate the system utilizing the system Ethernet communications, or dial up communications via modem, in the same format and method used on site as described under the Operator Interface section of this specification.
- E. Maintenance Management - The system shall monitor equipment status and generate maintenance messages based upon user designated run time, starts, and/or calendar date limits.
- F. Chiller Sequencing - Provide applications software to properly sequence the chiller plant to minimize energy use. This application shall perform the following functions:
1. The chiller plant control application shall have the ability to control up to 3 chillers as detailed in the sequence of operations.
 2. This application shall be able to control both constant and variable flow systems as well as parallel, series and decoupled piping configurations.
 3. The chiller plant control application shall be able to control multiple chiller plants per site.
 4. Diagnostics/Protection - The chiller plant application program shall be able to integrate individual chiller diagnostics into control action decisions.
 5. Event Processing - All chiller plant control and status events shall be recorded, at the operator's selection, in the building management system event log to facilitate troubleshooting.
 6. Alarm Indications - The chiller plant control status screens shall display chiller plant and individual chiller alarm messages.
 7. Add/Subtract Actions - The status screens shall provide information on when the next chiller add or subtract action will occur. The operator shall have the ability to manually force a chiller addition or a chiller subtraction.

- G. PID Control - A PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-wind-up shall be supplied. The algorithm shall calculate a time-varying analog value used to position an output or stage a series of outputs. The controlled variable, set point, and PID gains shall be user-selectable. The set-point shall optionally be chosen to be a reset schedule.
- H. Timed Override - A standard application shall be utilized to enable/disable temperature control when a user selects on/cancel at the zone sensor, workstation, or the operator display. The amount of time that the override takes precedence will be selectable from the workstation.
- I. Staggered Start - This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts shall be user-selectable.
- J. System Calculations - Provide software to allow instantaneous power (e.g. KW), flow rates (e.g. L/s [GPM]) to be accumulated and converted to energy usage data. Provide an algorithm that calculates a sliding-window KW demand value. Provide an algorithm that calculates energy usage and weather data (heating and cooling degree days). These items shall all be available for daily, previous day, monthly and the previous month.
- K. Anti-Short Cycling - All binary output points shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.

2.5 BUILDING CONTROLLERS

- A. General - Provide Building Controllers to provide the performance specified in section 1 of this division. Each of these panels shall meet the following requirements.
 - 1. The Building Automation System shall be composed of one or more independent, standalone, microprocessor based Building Controllers to manage the global strategies described in System software section.
 - 2. The Building Controller shall have sufficient memory to support its operating system, database, and programming requirements.
 - 3. The controller shall provide a communications port for connection of the portable operator's terminal.
 - 4. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
 - 5. Controllers that perform scheduling shall have a real time clock.
 - 6. Data shall be shared between networked Building Controllers.
 - 7. The Building Controller shall utilize industry recognized open standard protocols of BACnet or LonTalk for communication to unit controllers.
 - 8. The Building Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:
 - a) Assume a predetermined failure mode.
 - b) Generate an alarm notification.
 - c) Create a retrievable file of the state of all applicable memory locations at the time of the failure.
 - d) Automatically reset the Building Controller to return to a normal operating mode.
- B. Communications - Each Building Controller shall reside on a BACnet or LonTalk internetwork

using the ISO 8802-3 (Ethernet) Physical/Data Link layer protocol. Each Building Controller shall perform routing to a network of Custom Application and Application Specific Controllers.

- C. Communications - Each Building Controller shall reside on the Enterprise wide network, which is same high-speed network as the workstations. The Enterprise wide network will be provided by the owner and supports the Internet Protocol (IP). Local connections of the Building Controller shall be on ISO 8802-3 (Ethernet). Each Building Controller shall also perform routing to a network of Custom Application and Application Specific Controllers.
- D. Environment - Controller hardware shall be suitable for the anticipated ambient conditions. Controller used in conditioned ambient shall be mounted in an enclosure, and shall be rated for operation at 32 F to 120 F.
- E. Serviceability - Provide diagnostic LEDs for power, communications, and processor. The Building Controller shall have a display on the main board that indicates the current operating mode of the controller. All wiring connections shall be made to field removable, modular terminal strips or to a termination card connected by a ribbon cable. The primary logic board shall be removable without disconnecting field wiring.
- F. Memory - The Building Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
- G. Immunity to Power and Noise - Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shut-down below 80% nominal voltage
- H. Building Controller Operator Display - Each building controller shall include an operator display allowing the user to perform basic daily operations tasks on the building automation system. At a minimum this operator display shall:
 - 1. Be installed on the building controller and require no additional power source.
 - 2. Consist of a one-quarter VGA touch screen with 320 X 240-pixel resolution. The brightness and the contrast of the backlit touch screen shall be adjustable to allow for easy reading of information on the screen.
 - 3. Be capable of having unique user identification and passwords that can be programmed to limit access to the system and operator functions.
 - 4. Display the current state of an input/output point and equipment controller connected to the system.
 - 5. Give the operator the ability to override the current state of an output point or HVAC equipment controller connected to the building controller.
 - 6. Allow the operator to modify the start and stop times of any time-of-day schedule within the system.
 - 7. Provide a visual indication that a system alarm exists and allow for an optional audible alarm annunciation.
 - 8. Provide the ability to view and acknowledge alarms that are annunciated at that building controller.
 - 9. Allow the operator to view custom graphical displays with dynamic status information.
 - 10. Automatically update displayed system information every 10 seconds.

2.6 CONTROLLERS

- A. General - Provide Custom Application Controllers to provide the performance specified in

Section 1 of this division. Each of these panels shall meet the following requirements.

1. The Controller shall have sufficient memory to support its operating system, database, and programming requirements.
 2. Controllers that perform scheduling shall have a real time clock.
 3. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
 4. The Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall assume a predetermined failure mode, and generate an alarm notification.
 5. Custom application controllers shall communicate using LonTalk. Controllers shall use FTT-10 transceivers. All communications shall be with the use of LonMark-approved SNVTs.
- B. Environment - Controller hardware shall be suitable for the anticipated ambient conditions.
1. Controller used in conditioned ambient shall be mounted in NEMA 1 type enclosures, and shall be rated for operation at 32 F to 120 F.
 2. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40 F to 158 F.
- C. A local operator interface shall be provided at building locations where specified in the sequence of operations or point list. The operator interface shall be provided for interrogating and editing data. A system security password shall be available to prevent unauthorized use of the keypad and display.
1. Serviceability - Provide diagnostic LEDs for power, communications, and processor. All low voltage wiring connections shall be made such that the controller electronics can be removed and/or replaced without disconnection of field termination wiring.
 2. Memory - The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
 3. Immunity to Power and Noise - Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.

2.7 APPLICATION SPECIFIC CONTROLLERS

- A. General - Application specific controllers (ASC) are microprocessor-based DDC controllers, which through hardware or firmware design are dedicated to control a specific piece of equipment. They are not fully user programmable, but are customized for operation within the confines of the equipment they are designed to serve.
1. Each ASC shall be capable of stand-alone operation and shall continue to provide control functions without being connected to the network.
 2. Each ASC will contain sufficient I/O capacity to control the target system.
- B. Environment - The hardware shall be suitable for the anticipated ambient conditions.
1. Controller used in conditioned ambient spaces shall be mounted in NEMA 1 type rated enclosures. Controllers located where not to be disturbed by building activity (such as above ceiling grid), may be provided with plenum-rated enclosures and non-enclosed

wiring connections for plenum cabling. All controllers shall be rated for operation at 32 F to 120 F.

2. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40 F to 150 F.
- C. Serviceability - Provide diagnostic LEDs for power and communications. All wiring connections shall be clearly labeled and made to be field removable.
- D. Memory - The Application Specific Controller shall maintain all BIOS and programming information in the event of a power loss for at least 90 days.
- E. Immunity to Power and Noise - Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%.
- F. Transformer - Power supply for the ASC must be rated at minimum of 125% of ASC power consumption, and shall be fused or current limiting type.
- G. Application Specific Controllers shall communicate using LonTalk. Controllers shall use FTT-10 transceivers. All communications shall follow LonMark profiles. ASCs which do not have a profile that applies must comply with LonMark standards, utilize SNVTs for all listed points, and be provided with a XIF file for self-documentation.

2.8 INPUT/OUTPUT INTERFACE

- A. Hard-wired inputs and outputs may tie into the system through Building, Custom, or Application Specific Controllers.
- B. All input points and output points shall be protected such that shorting of the point to itself, another point, or ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.
- C. Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices.
- D. Pulse Accumulation Input Points - This type of point shall conform to all the requirements of Binary Input points, and also accept up to 3 pulses per second for pulse accumulation, and shall be protected against effects of contact bounce and noise.
- E. Analog inputs shall allow the monitoring of low voltage (0-10 Vdc), current (4-20 ma), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with, and field configurable to commonly available sensing devices.
- F. Binary outputs shall provide for on/off operation. Terminal unit and zone control applications may use 2 outputs for drive-open, drive-close modulating control. Binary outputs on custom application controllers shall have 3-mode (on/off/auto) program override control from the panel with output status lights.
- G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0-10 Vdc or a 4-20 ma signal as required to provide proper control of the

output device. Analog outputs on custom application controllers shall have a 2-mode (auto/manual) program override control, with manual output adjustment over 0-100% of range.

2.9 AUXILIARY CONTROL DEVICES

A. Motorized dampers, unless otherwise specified elsewhere, shall be as follows:

1. Damper frames shall be 16 gauge galvanized sheet metal or 1/8" extruded aluminum with reinforced corner bracing.
2. Damper blades shall not exceed 8" in width or 48" in length. Blades are to be suitable for medium velocity performance (2,000 fpm). Blades shall be not less than 16 gauge.
3. Damper shaft bearings shall be as recommended by manufacturer for application.
4. All blade edges and top and bottom of the frame shall be provided with compressible seals. Side seals shall be compressible stainless steel. The blade seals shall provide for a maximum leakage rate of 10 CFM per square foot at 2.5" w.c. differential pressure.
5. All leakage testing and pressure ratings will be based on AMCA Publication 500.
6. Individual damper sections shall not be larger than 48" x 60". Provide a minimum of one damper actuator per section.

B. Control dampers shall be parallel or opposed blade types as scheduled on drawings.

C. Electric Damper/Valve Actuators

1. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.
2. Where shown, for power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing.
3. All rotary spring return actuators shall be capable of both clockwise or counter clockwise spring return operation. Linear actuators shall spring return to the retracted position.
4. Proportional actuators shall accept a 0-10 VDC or 0-20 ma control signal and provide a 2-10 VDC or 4-20 ma operating range.
5. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb. torque capacity shall have a manual crank for this purpose.
6. Actuators shall be provided with a conduit fitting and a minimum 1m electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.
7. Actuators shall be Underwriters Laboratories Standard 873 listed.
8. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque.

D. Control Valves

1. Control valves shall be two-way or three-way type for two-position or modulating service as scheduled or shown.
2. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
 - a) Water Valves:
Two-way: 200 PSIG Close Off Rating-Nema 4 Actuator with built in heater and T-

Stat.

3. Water Valves:
 - a) Body and trim style and materials shall be per manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
 - b) Sizing Criteria:
 - i. Two-position service: Line size.
 - ii. Two-way modulating service: Pressure drop shall be equal 1 PSIG.
 - iii. Valves 1/2" through 2" shall be bronze body or cast brass ANSI Class 250, Teflon packing, quick opening for two-position service. Two-way valves to have replaceable composition disc, or stainless steel ball.
 - iv. 2-1/2" valves and larger shall be cast iron ANSI Class 125 with guided plug and Teflon packing.
 - c) Water valves shall fail normally open or closed as scheduled on plans or as follows:
 - i. Heating coils in air handlers - normally open or last position.
 - ii. Chilled water control valves - normally closed or last position.
 - iii. Other applications - as scheduled or as required by sequence of operation.
 - d) Zone valves shall be sized to meet the control application and they shall maintain their last position in the event of a power failure.

E. Binary Temperature Devices

1. Low-Voltage Space Thermostats shall be 24 V, bimetal-operated, mercury-switch type, with either adjustable or fixed anticipation heater, concealed setpoint adjustment, 55°F-85°F setpoint range, 2°F maximum differential, and vented cover.
2. Line-Voltage Space Thermostats shall be bimetal-actuated, open-contact type or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listing for electrical rating, concealed setpoint adjustment, 55°F-85°F setpoint range, 2°F maximum differential, and vented cover.
3. Low-Limit airstream thermostats shall be UL listed, vapor pressure type. Element shall be at least 20 ft long. Element shall sense temperature in each 1 ft section and shall respond to lowest sensed temperature. Low-limit thermostat shall be manual reset only.

F. Temperature Sensors

1. Temperature sensors shall be Resistance Temperature Device (RTD) or Thermistor.
2. Duct sensors shall be rigid or averaging as shown. Averaging sensors shall be a minimum of 5 feet in length.
3. Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.
4. Space sensors shall be equipped with set-point adjustment, override switch, display, and/or communication port as shown on the drawings.
5. Provide matched temperature sensors for differential temperature measurement. Differential accuracy shall be within 0.2 F.
6. The space temperature, setpoint, and override confirmation will be annunciated by a digital display for each zone sensor. The setpoint will be selectable utilizing buttons.

G. Humidity Sensors

1. Duct and room sensors shall have a sensing range of 20% to 80% with accuracy of $\pm 2\%$ R.H.

2. Duct sensors shall be provided with a sampling chamber.
3. Outdoor air humidity sensors shall have a sensing range of 20% to 95% R.H. It shall be suitable for ambient conditions of -40 F to 170 F.
4. Humidity sensor's drift shall not exceed 1% of full scale per year.

H. Static Pressure Sensors

1. Sensor shall have linear output signal. Zero and span shall be field-adjustable.
2. Sensor sensing elements shall withstand continuous operating conditions plus or minus 50% greater than calibrated span without damage.
3. Water pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150-psi minimum. Sensor shall be complete with 4-20 ma output, required mounting brackets, and block and bleed valves. Mount in location accessible for service.
4. Water differential pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150-psi minimum. Over-range limit (DP) and maximum static pressure shall be 3,000 psi. Transmitter shall be complete with 4-20 ma output, required mounting brackets, and five-valve manifold. Mount in a location accessible for service.

I. Low Limit Thermostats

1. Safety low limit thermostats shall be vapor pressure type with an element 20 ft minimum length. Element shall respond to the lowest temperature sensed by any one foot section.
2. Low limit shall be manual reset only.

J. Carbon Dioxide (CO₂ Sensors)

1. Carbon Dioxide sensors shall measure CO₂ in PPM in a range of 0-2000 ppm. Accuracy shall be +/- 3% of reading with stability within 5% over 5 years. Sensors shall be duct or space mounted as indicated in the sequence of operation.

K. Flow Switches

1. Flow-proving switches shall be differential pressure type, as shown.
2. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 Type enclosure, with scale range and differential suitable for intended application, or as specified.

L. Relays

1. Control relays shall be UL listed plug-in type with dust cover. Contact rating, configuration, and coil voltage suitable for application.
2. Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable plus or minus 200% (minimum) from set-point shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide NEMA 1 Type enclosure when not installed in local control panel.

M. Transformers and Power Supplies

1. Control transformers shall be UL listed, Class 2 current-limiting type, or shall be furnished with over-current protection in both primary and secondary circuits for Class 2 service.

2. Unit output shall match the required output current and voltage requirements. Current output shall allow for a 50% safety factor. Output ripple shall be 3.0 mV maximum Peak-to-Peak. Regulation shall be 0.10% line and load combined, with 50-microsecond response time for 50% load changes. Unit shall have built-in over-voltage protection.
3. Unit shall operate between 32°F and 180°F.
4. Unit shall have UL label.

N. Current Switches

1. Current-operated switches shall be self-powered, solid state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

O. Local Control Panels

1. All indoor control cabinets shall be fully enclosed NEMA 1 Type construction with hinged door, and removable sub-panels or electrical sub-assemblies.
2. Interconnections between internal and face-mounted devices shall be pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
3. Provide on/off power switch with over-current protection for control power sources to each local panel.

PART 3: EXECUTION

3.0 SECTION INCLUDES:

3.1 EXAMINATION

- A. The project plans shall be thoroughly examined for control device and equipment locations, and any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started.
- B. The contractor shall inspect the site to verify that equipment is installable as shown, and any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started.

3.2 PROTECTION

- A. The Contractor shall protect all work and material from damage by his/her work or workers, and shall be liable for all damage thus caused.
- B. The Contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The Contractor shall protect his/her work against theft or damage, and shall carefully store material and equipment received on site that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 GENERAL WORKMANSHIP

- A. Install equipment, piping, wiring/conduit parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.
- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- C. Install all equipment in readily accessible location as defined by chapter 1 article 100 part A of the NEC. Control panels shall be attached to structural walls unless mounted in equipment enclosure specifically designed for that purpose. Panels shall be mounted to allow for unobstructed access for service.
- D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
- E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.4 FIELD QUALITY CONTROL

- A.. All work, materials and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this Section.
- B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship. All visible piping and or wiring runs shall be installed parallel to building lines and properly supported.
- C. Contractor shall arrange for field inspections by local and/or state authorities having jurisdiction over the work.

3.5 WIRING

- A. All control and interlock wiring shall comply with the national and local electrical codes and Division 16 of these specifications. Where the requirements of this section differ with those in Division 16, the requirements of this section shall take precedence.
- C. All cables shall be UL listed for application, i.e., cables used in ceiling plenums shall be UL listed specifically for that purpose.
- D. Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage may not be used for low voltage wiring except for the purpose of interfacing the two (e.g. relays and transformers).
- E. Where class 2 wiring is run exposed, wiring shall be run parallel along a surface or perpendicular to it, and bundled, using approved wire ties at no greater than 10 ft intervals. Such bundled cable shall be fastened to the structure, using specified fasteners, at 5 ft intervals or more often to achieve a neat and workmanlike result.
- F. All wire-to-device connections shall be made at a terminal blocks or terminal strip. All wire-to-wire connections shall be at a terminal block, or with a crimped connector. All wiring within

enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

- G. Maximum allowable voltage for control wiring shall be 120V. If only higher voltages are available, the Control System Contractor shall provide step down transformers.
- H. All wiring shall be installed as continuous lengths, where possible. Any required splices shall be made only within an approved junction box or other approved protective device.
- I. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations in accordance with other sections of this specification and local codes.
- J. Size of conduit and size and type of wire shall be the design responsibility of the Control System Contractor, in keeping with the manufacturer's recommendation and NEC.
- K. Control and status relays are to be located in designated enclosures only. These relays may also be located within packaged equipment control panel enclosures. These relays shall not be located within Class 1 starter enclosures.
- L. Follow manufacturer's installation recommendations for all communication and network cabling. Network or communication cabling shall be run separately from other wiring.
- M. Adhere to Division 16 requirements for installation of raceway.
- N. This Contractor shall terminate all control and/or interlock wiring and shall maintain updated as-built wiring diagrams with terminations identified at the job site.
- O. Flexible metal conduits and liquid-tight, flexible metal conduits shall not exceed 3' in length and shall be supported at each end. Flexible metal conduit less than 1/2" electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal conduits shall be used.
- P. 120 Vac power to VAV Boxes by Div 16, 120Vac power to controllers by ATC.
- Q. All Control cables will be in EMT Conduit.

3.6 INSTALLATION OF SENSORS

- A. Install sensors in accordance with the manufacturer's recommendations.
- B. Mount sensors rigidly and adequate for the environment within which the sensor operates.
- C. Room temperature sensors shall be installed on surface mounted wall junction boxes properly supported by the wall framing.
- D. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor readings.
- E. Install duct static pressure tap with tube end facing directly down-stream of airflow.
- F. Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type.

- G. Averging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.
- H. All pipe mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat conducting fluid in thermal wells.
- I. Wiring for space sensors shall be surface mounted to the building walls. EMT conduit is acceptable within mechanical and service rooms.
- J. Install outdoor air temperature sensors on north wall complete with sun shield at designated location.
- K. Furnish and install smoke detectors in each air handling unit and each rooftop unit. Detector shall shut unit down and be interlocked with the building fire alarm system.

3.7 FLOW SWITCH INSTALLATION

- A. Install and adjust flow switch in accordance with manufacturers' instructions. ATC to calibrate to open if water flow falls below minimum.
- B. Assure correct flow direction and alignment.
- C. Mount in horizontal piping - flow switch on top of the pipe.

3.8 ACTUATORS

- A. Mount and link control damper actuators per manufacturer's instructions.
 1. To compress seals when spring return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.
 2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
 3. Valves - Actuators shall be mounted on valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following manufacturer's recommendations.

3.9 WARNING LABELS

- A. Affix labels on each starter and equipment automatically controlled through the DDC System. Warning label shall indicate the following:

CAUTION

This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.

- A. Affix labels to motor starters and control panels that are connected to multiple power sources utilizing separate disconnects. Labels shall indicate the following:

CAUTION

This equipment is fed from more than one power source with separate disconnects.
Disconnect all power sources before servicing.

3.10 IDENTIFICATION OF HARDWARE AND WIRING

- A. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2" of termination with a cable identifier and other descriptive information.
- B. Permanently label or code each point of field terminal strips to show the instrument or item served.
- C. Identify control panels with minimum 1/2" letters on nameplates.
- D. Identify all other control components with permanent labels. Identifiers shall match record documents. All plug-in components shall be labeled such that removal of the component does not remove the label.

3.11 CONTROLLERS

- A. Provide a separate Controller for each major piece of HVAC equipment. A custom application controller may control more than one system provided that all points associated with that system are assigned to the same controller. Points used for control loop reset such as outside air or space temperature are exempt from this requirement.
- B. Building Controllers and Custom Application Controllers shall be selected to provide a minimum of 15% spare I/O point capacity for each point type found at each location. If input points are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point used.
 - 1. Future use of spare capacity shall require providing the field device, field wiring, points database definition, and custom software. No additional Controller boards or point modules shall be required to implement use of these spare points.

3.12 PROGRAMMING

- A. Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 25% of available memory free for future use.
- B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index.
- C. Software Programming
 - 1. Provide programming for the system as written in the specifications and adhere to the sequence strategies provided. All other system programming necessary for the operation of the system but not specified in this document shall also be provided by the Control System Contractor. Imbed into any custom-written control programs sufficient comment

statements or inherent flow diagrams to clearly describe each section of the program. The comment statements shall reflect the language used in the sequence of operations.

D. Operator's Interface

1. Standard Graphics - Provide graphics for each major piece of equipment and floor plan in the building. This includes each Chiller, Air Handler, VAV Terminal, Fan Coil, Boiler, etc. these standard graphics shall show all points dynamically as specified in the points list.
 2. The controls contractor shall provide all the labor necessary to install, initialize, start-up, and trouble-shoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface database, and any third party software installation and integration required for successful operation of the operator interface.
 3. As part of this execution phase, the controls contractor will perform a complete test of the operator interface. Test duration shall be a minimum of 16 hours on-site. Tests shall be made in the presence of the Engineer or Owner's representative.
- E. Demonstration - A complete demonstration and readout of the capabilities of the monitoring and control system shall be performed. The contractor shall dedicate a minimum of 16 hours on-site with the Owner and his representatives for a complete functional demonstration of all the system requirements. This demonstration constitutes a joint acceptance inspection, and permits acceptance of the delivered system for on-line operation.

3.13 CLEANING

- A. This contractor shall clean up all debris resulting from his or her activities daily. The contractor shall remove all cartons, containers, crates, etc. under his control as soon as their contents have been removed. Waste shall be collected and placed in a location designated by the Prime Contractor.
- B. At the completion of work in any area, this Contractor shall clean all of his/her work, equipment, etc., making it free from dust, dirt and debris, etc.
- C. At the completion of work, all equipment furnished under this Section shall be checked for paint damage, and any factory finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.14 TRAINING

- A. Provide a minimum of 4 classroom training sessions, 4 hours each, throughout the contract period for personnel designated by the Owner. Computer-based audio-visual training may be substituted for up to 8 hours of hands on training with the approval of the Engineer/Owner.
- B. Train the designated staff of Owner's representative and Owner to enable them to proficiently operate the system; create, modify and delete programming; add, remove and modify physical points for the system, and perform routine diagnostic and troubleshooting procedures.

- C. Additional training shall be included in courses designed to meet objectives as divided into three logical groupings; participants shall attend two or more of these, depending on the level of knowledge required:
 - 1. Day-to-day Operators
 - 2. Advanced Operators
 - 3. System Managers/Administrators
- D. Provide course outline and materials as per Part 1 of this Section. The instructor shall provide one copy of training material per student.
- E. The instructor shall be factory-trained instructors experienced in presenting this material.
- F. Classroom training shall be done using a network of working controllers representative of the installed hardware or at the customer's site.
- G. Training shall be made available in addition to the interactive audio-visual tutorial, provided with the system.

3.15 ACCEPTANCE

- A. The control systems will not be accepted as meeting the requirements of Completion until all tests described in this specification have been performed to the satisfaction of both the engineer and owner. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the Completion requirements if stated as such in writing by the Owner's representative. Such tests shall then be performed as part of the warranty.

PART 4: SEQUENCE OF OPERATIONS

4.01 VARIABLE AIR VOLUME AIR HANDLER UNIT WITH HYDRONIC HEATING/COOLING (APPLICATION SPECIFIC CONTROLLER)

- A. Occupancy - The occupancy mode can be scheduled by the ASC, communicated or hardwired to the ASC via a binary input. Valid Occupancy modes for the ASC shall be:
 - 1. Occupied: Normal operating mode for occupied spaces or daytime operation.
 - 2. When the unit is in the occupied mode the ASC shall maintain the discharge air temperature at the active discharge heating or cooling setpoint for humidity control. Humidistat's shall be located in a common return air duct at each AHU. The occupied mode shall be the default mode of the ASC. The chilled water and reheat coil valves shall modulate in sequence to maintain the supply air temperature at 53 F (adjustable). If the building humidity level rises above 60% RH (adjustable), the chilled water valve shall modulate to maintain the chilled water coil leaving air temperature at 53 F, and the reheat coil valve shall modulate to maintain the supply air temperature at 57 F (adjustable).

The supply fan VFD shall be modulated to maintain building CO₂ levels at setpoint of 1100 ppm (adjustable). If the CO₂ level is below setpoint, the fan shall modulate to its minimum speed.

3. Unoccupied: Normal operating mode for unoccupied spaces or nighttime operation. For Unoccupied operation the ASC shall receive a space temperature, either hardwired or communicated. When the space temperature is off the heating or cooling unoccupied temperature setpoints plus/minus an offset the ASC shall start the fan and enable the primary heating or cooling capacities to maintain the discharge air temperature at the active discharge air temperature setpoint. The outside Air damper shall remain closed, unless economizing.

Unoccupied Cooling Setpoint	85°F (adjustable)
Unoccupied Heating Setpoint	60°F (adjustable)

4. Occupied Bypass: Mode used to temporarily place the unit into the occupied operation. The Occupied Bypass mode can be enabled from the local display, via a communicated value or hardwired from the space sensor. When a space sensor is available tenants shall be able to override the unoccupied mode locally. The override shall last for a maximum of 4 hours (configurable). The tenants shall be able to cancel the override from the space sensor at any time. During the override the unit shall run in occupied mode.

- B. Cooling Operation - When the unit is in cooling mode, the ASC shall maintain the discharge temperature at the active discharge cooling setpoint. Based on the ASC occupancy mode, the active discharge cooling setpoint shall be:

Occupied Discharge Air Cooling Setpoint	55°F (adjustable)
Unoccupied Discharge Air Cooling Setpoint	55°F (adjustable)

The ASC shall use the active discharge air temperature cooling setpoint and the discharge air temperature to determine the requested cooling capacity of the unit (0-100%). The outputs shall be controlled based on the unit configuration and the requested cooling capacity.

- C. The discharge cooling setpoints shall be limited by adjustable parameters in the ASC to prevent them from being set too low or too high.

Setpoint	Default Value
Maximum Discharge Air Cooling Setpoint	68°F (adjustable)
Minimum Discharge Air Cooling Setpoint	50°F (adjustable)

- D. Transition from Unoccupied to Occupied - When the unit transitions from unoccupied mode to the occupied mode, morning warm-up routine shall be activated.

1. Morning Warm-Up - When there is a call for heating and the space temperature is 1.5°F or more below the occupied heating setpoint a morning warm-up sequence shall be activated. During warm-up the fan shall be turned on, the outside air damper shall remain closed, and the heating capacity shall be controlled to the discharge heating setpoint. When the space temperature reaches the occupied heating setpoint the ASC shall operate in occupied mode.
2. Pre-Cool mode is communicated only- During Pre-Cool, the fan shall be turned on, the outside air damper shall remain closed, and the cooling capacity shall be controlled to the discharge cooling setpoint.

- E. VAV Fan Operation: The ASC shall always maintain duct static setpoint in all modes of operating with the fan on. When the fan is on the ASC shall read and compare the duct static pressure input to the duct static pressure setpoint and adjust the supply fan speed accordingly.
1. Hydronic Cooling Valve Control- If the unit is in the cooling or dehumidification mode the ASC shall modulate the cooling valve to maintain the discharge air temperature at the active discharge air temperature setpoint. If the economizer function is enabled and the outside air damper is not fully open the cooling valve shall be closed. The cooling valve shall be closed if the fan is off or if the heating valve is open. The cooling valve will be fully open if the outside air temperature is below the freeze avoidance setpoint 35°F, operator adjustable. All valves will be slow acting and tuned to the application by the ATC to maintain control stability as chillers are added and taken off line.
- F. Outside Air Damper Control - During all occupied modes the outside air damper shall be controlled to the effective minimum position 15% operator adjustable, unless the economizing mode or mixed air temperature control routines are active. The outside air damper shall be closed during the Unoccupied mode, morning warm-up and pre-cool modes or when the outside air temperature falls below a Low Ambient Damper Lockout Setpoint -20°F, operator adjustable.
- G. Mixed Air Temperature Control - The ASC shall reduce the outside air damper below the minimum position to maintain the mixed air temperature above the Mixed Air Low Limit Setpoint 48°F, operator configurable. If the mixed air temperature sensor fails the outside air damper shall be closed.
- H. The Building Automation System (BAS) shall send the ASC the occupied space heating and cooling temperature setpoints. The BAS shall also send the following commands:
- Occupied
 - Unoccupied
 - Heat/Cool Mode
 - Economizer Enable
 - Priority Shutdown Commands
 - Morning Warm-up/Pre-cool
 - Timed Override
 - Night Economizing
- If communication with the BAS is lost, the ASC shall use predetermined default setpoints and operate in the occupied mode.
- I. SAFETIES AND ALARMS
1. Space Sensor Failure - If there is a fault with the operation of the zone sensor module, it shall be feed back to the BAS. Zone sensor failure shall cause the unit to shutdown.
 2. Run/Stop Input - The ASC shall stop the unit completely when a binary input closes. This binary input shall be controlled by an external system like smoke control or fire safety. Normal operation shall be resumed when the input opens.

3. Fan Status - The ASC shall monitor the fan outputs to determine fan status with CT's. If after a minute of energizing the fan output or during normal operation the fan status switch indicates no fan operation, the ASC shall perform a shutdown and generate a Fan Failure diagnostic. The diagnostic shall be reset manually.
 4. Exhaust Fan Status - The ASC shall monitor the exhaust fan outputs to determine fan status with CT's. If after a minute of energizing the fan output or during normal operation the exhaust fan status switch indicates no fan operation, the ASC shall perform a shutdown and generate an Exhaust Fan Failure diagnostic. The diagnostic shall be reset manually.
 5. Filter Status - A normally open, operator configurable, differential pressure switch shall monitor the differential pressure across the filter when the fan is running. If during normal operation the switch closes a dirty filter alarm shall be issued.
 6. Reset - All diagnostics shall be capable of being reset through the zone sensor, service tool, BAS, or by cycling power to the unit.
 7. Low Temperature Detection - A binary signal will shut the unit down, close the outside air damper, and open all valves when the discharge air temperature falls below 35 °F (factory configured). A Low Coil Temperature Detect diagnostic shall be generated.
 8. Unoccupied Freeze Avoidance - The ASC shall open all valves when the outside air temperature drops below 38°F (operator configurable) during the unoccupied mode.
 9. Fan Off Delay - After heating has being controlled off, the ASC shall keep the fan energized for an additional 30 seconds. The purpose of this action is to remove residual heat from the heating source.
 10. Pump Status – The ASC shall monitor the pump outputs to determine pump status with CT's.
- J. The BAS system shall provide alarm messages for the following ASC diagnostics. The ASC shall initiate a failsafe operational sequence based on the diagnostic condition.
- | | |
|-------------------------------------|-----------------------|
| Diagnostic | Manual Reset required |
| Emergency Override | No |
| Low Temp Detect | Yes |
| Unit Shutdown | Yes |
| Low Supply Fan Airflow | Yes |
| Discharge Air Temp Failure | Yes |
| Space Temperature Failure | No |
| Low Exhaust Fan Air Flow | Yes |
| Outdoor Air Temp Failure | No |
| Mixed Air Temp Failure | No |
| Duct static pressure high limit | Yes |
| Dirty Filter | No |
| Maintenance Required | No |
| Duct Static Pressure Sensor Failure | No |
| Local Setpoint Failure | No |

K. TROUBLESHOOTING

1. Manual Output Test - The ASC shall be able to manually exercise all outputs for troubleshooting. This shall be done directly from the controller board with no need of additional tools.
2. Unit Identification - The ASC shall have the capability of flashing and LED upon receiving a command from a service tool or BAS. The ASC shall also be able to send the unit address to a service tool or BAS for unit identification from the controller board or space sensor with no need of additional tools.
3. Water Valve Override - This command from a service tool or BAS shall cause all valves to stroke fully open for water balancing.

L. COMMUNICATIONS

1. Data Sharing - All ASC's shall be able to communicate in a peer-to-peer environment over a twisted pair of communications wire.

4.02 CHILLER PLANT CONTROL

A. Control Strategies - The chiller plant control software shall perform the following control strategies for two air cooled chillers:

1. System Scheduling - The chiller plant control software shall start the chiller system based on a time of day schedule and ambient temperature. An override Input will allow the operator to manually override chiller system operation.
2. Chiller Start-up Sequence- The chiller plant control software will start and stop system water pumps and chillers based upon the outside air net bulb temperature.
 - a. When the chilled water system is enabled the chiller plant control program shall:
 - 1.) start the system chilled water pump.
 - 2.) allow the chiller to start the chilled water pump and prove flow through the evaporator.
 - 3.) start the lead chiller after chilled water pump flow is proven.
 - b. Lag chillers shall start whenever operating chillers' current draw (if available) continuously exceeds a user definable setting. The length of time the chiller load must remain above the load setting shall vary depending upon supply water temperature deviation from setpoint.
 - 1.) Lag chillers shall start in a similar manner to the lead chiller start sequence.
 - 2.) The chiller plant control program shall have the ability to unload operating chillers prior to starting a lag chiller. This shall be done to prevent system water flow disturbances (caused by lag chiller's pump starting) from interrupting running chillers operation.
 - 3.) The chiller plant control program shall control each chillers'

setpoint to equalize the chiller loading and meet system demands as the system load varies.

- 4.) When the system current draw drops below a user definable setting, the lag chiller shall be shut down, depending on system water temperature difference.
- 5.) The chiller plant control software will not shutdown the lag chiller pump until that chiller's compressor is proven off.

3. Add/Subtract Chiller Control - The criteria for adding and subtracting chillers shall be controlled as follows:

- a. Add Control shall be based on the system chilled water setpoint and the system chilled water supply temperature.
- b. Subtract Control shall be based on either the system chilled water delta T or chilled water flow, as selected by the operator.

The chiller plant control program shall allow adjustable time delays on add/subtract requests to prevent excessive chiller cycling.

4. Chiller Rotation - The operator shall be able to designate normal, base, peak and swing chillers to increase system efficiency and equalize chiller run time. Manual or automatic rotation of the chiller sequence shall be allowed. Rotation time interval shall be operator adjustable.

5. Chiller Soft Start - The chiller plant control software shall provide a user adjustable loading time at system start-up to limit system electrical demand during chilled water loop pulldown.

B. Custom Control Strategies - the chiller plant control program shall accept reference data from other programs/applications to perform custom programming strategies.

C. Chiller System Status Display - The chiller plant control software shall provide operating status for the system. The display shall include:

1. System mode of the chiller plant
2. Chiller enable/disable status
3. System supply water setpoint
4. System supply and return water temperature
5. System Chilled water pump status
6. System Chilled water flow
7. Bypass pipe temperature
8. Current chiller plant control operation
9. Add information
10. Subtract information
11. System failure information
12. Chiller failure information
13. Rotation information
14. Override capabilities to force an add control, subtract control, or change of sequence.
15. Remove a chiller from a sequence temporarily for service purposes.

- D. Diagnostics/Protection - The chiller plant control program shall be able to integrate individual chiller diagnostics into control action decisions.
- E. Event Processing - All chiller plant control and status events shall be recorded, at the operator's selection, in the building management system event log to facilitate troubleshooting.
- F. System Security - The chiller plant control system shall allow program security to be designated for each operator with a choice of the following functions:
 - 1. View chiller plant status
 - 2. Change chiller plant status
 - 3. View chiller plant setup
 - 4. Change chiller plant setup
- G. Alarm Indications - The chiller plant control status screens shall display chiller plant and individual chiller alarm messages.
- H. Failure Recovery - Upon sensing a chiller failure the chiller plant control software shall lockout that chiller and pump and immediately initiate the start of the next chiller in the rotation sequence.

A rapid power fail recovery capability returns the chiller plant to its last state (before the building controller lost power) as quickly as possible after the building controller powers up. The chiller plant control program will retry chillers (an operator entered number of tries) if all chillers have been marked as failed.

4.03 VAV BOX WITH REHEAT AND DDC CONTROLLER (DIRECT DIGITAL CONTROL)

- A. Occupancy – The occupancy mode can be communicated or hardwired to the VAV via a binary input. Valid occupancy modes for the VAV shall be:
 - 1. Occupied: Normal operating mode for occupied spaces or daytime operation. When the unit is in the occupied mode, the VAV shall maintain the space temperature at the active occupied heating or cooling setpoint. Applicable ventilation and airflow setpoints shall be enforced. The occupied mode shall be the default mode of the VAV.
 - 2. Unoccupied: Normal operating mode for unoccupied spaces or nighttime operation. When the unit is in unoccupied mode, the VAV shall maintain the space temperature at the stored unoccupied heating or cooling setpoint regardless of the presence of a hardwired or communicated setpoint. When the space temperature exceeds the active unoccupied setpoint, the VAV shall modulate fully closed.
 - 3. Occupied Bypass: Mode used to temporarily place the unit into the occupied operation. Tenants shall be able to override the unoccupied mode from the space sensor. The override shall last for a maximum of 4 hours (configurable). The tenants shall be able to cancel the override from the space sensor at any time. During the override the unit shall run in occupied mode.
- B. Heat Cool Mode – The Heat Cool Mode can be set by a communicated value or automatically by the VAV. In standalone or auto mode, the VAV shall compare the primary air temperature with the configured auto changeover setpoint to determine if the

air is “hot” or “cold”. Heating mode shall command the VAV to heat only; it implies the primary air temperature is hot. Cooling mode commands the VAV to cool only; it implies the primary air temperature is cold.

1. Heat Cool Setpoint – The space temperature setpoint shall be determined either by a local hardwired of a setpoint knob, the VAV default setpoint or a communicated value. The VAV uses the locally stored default setoints when neither a local hardwired setpoint nor communicated setpoint is present. If both a hardwired setpoint and communicated setpoint exist, the VAV shall use the communicated value.

a) The occupied heating and cooling setpoints shall be limited by adjustable parameters in the VAV to prevent them from being set too low or too high. These limits do not apply in the unoccupied mode. In the Unoccupied Mode, the VAV shall always use the stored default (Unoccupied) setpoints. These setppoints shall be widened to accommodate night setback and shall be adjustable.

Setpoint	Default Value
Heating Setpoint Low Limit	40°F
Cooling Setpoint Low Limit	40°F
Heating Setpoint High Limit	105°F
Cooling Setpoint High Limit	110°F

C. Cooling Operation - When the unit is in cooling mode, the VAV shall maintain the space temperature at the active cooling setpoint by modulating the airflow between the active cooling minimum airflow setpoint to the maximum cooling airflow setpoint. Based on the VAV occupancy mode, the active cooling setpoint shall be one of the following:

Setpoint	Default Value
Occupied Cooling Setpoint	74°F
Unoccupied Cooling Setpoint	85°F
Occupied Standby Cooling Setpoint	78°F
Occupied Min Cooling Airflow Setpoint	See VAV Schedule
Occupied Max Cooling Airflow Setpoint	See VAV Schedule

The VAV shall use the measured space temperature and the active cooling setpoint to determine the requested cooling capacity of the unit. The outputs shall be controlled based on the unit configuration and the requested cooling capacity.

D. Heating Operation - When the unit is in heating mode, the ASC shall maintain the space temperature at the active heating setpoint by modulating the airflow between the active heating minimum airflow setpoint to the maximum heating airflow setpoint. Based on the ASC occupancy mode, the active heating setpoint shall be one of the following:

Setpoint	Default Value
Occupied Heating Setpoint	71°F
Unoccupied Heating Setpoint	60°F
Occupied Standby Heating Setpoint	67°F
Occupied Min Heating Airflow Setpoint	See VAV Schedule
Occupied Max Heating Airflow Setpoint	See VAV Schedule

The ASC shall use the measured space temperature and the active heating setpoint to determine the requested heating capacity of the unit. The outputs shall be controlled based on the unit configuration and the requested heating capacity.

- E. Reheat Control - Reheat shall only be allowed when the primary air temperature is 5°F below the configured reheat enable setpoint, [70°F] Operator configurable. The reheat will be enabled when the space temperature drops below the active cooling setpoint and the airflow is in the minimum cooling airflow setpoint. During reheat the VAV shall operate at its minimum heating airflow setpoint and energize the heat as follows:

- 1. Proportional Hot Water Reheat - Below heating setpoint modulate the two way water valve as required to maintain the active heating setpoint.

- F. The Building Automation System (BAS) shall send the VAV the occupied space heating and cooling temperature setpoints. The BAS shall also send the following commands:

Occupied
 Unoccupied
 Heat/Cool Mode
 Priority Shutdown Commands

If communication with the BAS is lost, the VAV shall use predetermined default setpoints and operate in the occupied mode.

4.02.1 SAFETIES AND ALARMS

- A. Space Sensor Failure - If there is a fault with the operation of the zone sensor module, it shall be feed back to the BAS. Zone sensor failure shall cause the VAV to close and disable heat and Fan if available.
- B. Reset - All diagnostics shall be capable of being reset through the zone sensor, service tool, BAS, or by cycling power to the unit.
- C. The BAS system shall provide alarm messages for the following VAV diagnostics. The VAV shall initiate a failsafe operational sequence based on the diagnostic condition.

Diagnostic	Manual Reset Required
Discharge Air Temperature Failure	Yes
Low Air Flow	Yes
Primary Air Temperature Failure	No
Space Temperature Failure	Yes
Local Setpoint Failure	No
Flow Sensor Failure	No

4.02.2 TROUBLESHOOTING

- A. Manual Output Test - The VAV shall be able to manually exercise all outputs for troubleshooting. This shall be done directly from the controller board with no need of additional tools.

- B. Unit Identification - The VAV shall have the capability of flashing an LED upon receiving a command from a service tool or BAS. The VAV shall also be able to send the unit address to a service tool or BAS for unit identification from the controller board or space sensor with no need of additional tools.

4.02.3 COMMUNICATIONS

- A. Data Sharing - All VAVs shall be able to communicate in a peer-to-peer environment over a twisted pair of communications wire.

Master/Slave - Master/Slave shall be used for operating multiple units from a single space sensor. The Master unit shall share space temperature, setpoint, heat/cool mode, occupancy, fan operation, and capacity control algorithm data over a twisted pair of communication wire to ensure seamless cooperation between the units.

4.04 MISCELLANEOUS EQUIPMENT SEQUENCES

- A. The hot water system consists of three hot water boilers and headered hot water distribution pumps. The system is DDC controlled with electric actuation.
- B. The system shall operate as follows (All set points and settings are adjustable.)

- 1. Pump Alternation

- Pumps alternate to equalize equipment runtime. Selection of the lead and standby pump is evaluated on a weekly basis. The pump with the least runtime is the lead. The pump with the most runtime is the third and the remaining pump is second.

- 2. Heating Control

- At the beginning of the heating season, as defined by the heating system enable point being energized (manually by the operator or by program function (i.e., Time-of-Day)), the boiler manufacturer's control panel receives a signal from the EMS to start the boilers. When the central panel calls for a boiler to energize, the associated boiler isolation valve opens. When flow is proven, the boiler is energized and maintains the leaving water set point as determined by the boiler control panel. The control panel will stage a second boiler on in the event that the first boiler cannot maintain the common HW supply temperature at set point. The boilers run continuously during the heating season maintaining the minimum required water temperature. At the end of the heating season (heating system enable point is deenergized), the boilers and distribution pumps are turned off.

If the heating system enable point is on, the lead heating distribution pumps starts. The pump VFD speed will be modulated to maintain system differential pressure at set point (adjustable). If the lead pump goes into alarm, the standby pump will be started and will maintain system differential pressure at set point.

The boiler manufacturer's control panel will reset the supply water set point based on outdoor air temperature. When the outdoor air temperature is 30 degrees F (-18 degrees C), the set point is 180 degrees F (82 degrees C) and when the outdoor air temperature is 60 degrees F (16 degrees C), the set point is 110

degrees F (60 degrees C). The boilers will maintain the set point by modulating the rate of combustion.

If a boiler goes into alarm, it is turned off and the next boiler in sequence takes over. If a pump fails, an alarm is generated and the next pump in sequence takes over.

The boiler control system, provided by the boiler manufacturer, is factory wired except for field installed devices (combustion air damper interlocks, flow switches, low water cut off, etc.). Flame safeguard controls are included with the boiler.

The DDC system uses current switches to confirm the pumps are in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

The DDC system monitors the boiler controls for a common alarm condition (i.e. low water cut off, flame failure, etc.).

The DDC system generates an alarm when the water temperature is outside the minimums or maximums as required by the boiler manufacturer (i.e. differential temperature too large or too small, return or supply temperature too low, etc.) A communications link with the boiler manufacturer's control panel will provide all of the available boiler system points to be imported directly into the EMS.

C. Chilled Water Pumps

1. Chilled water pumps shall be enabled by the EMS or operator command. When the system calls for cooling, the lead chilled water pump shall start. Pump speed will be modulated to maintain the system differential pressure at setpoint. The setpoint shall be determined by the TAB by setting all AHU's to full cooling mode and measuring the differential pressure required to maintain proper chilled water flow to the units.
2. If the lead pump fails to start or goes into alarm, the backup pump associated with the system shall start and an alarm will be generated at the operator workstation.

D. Exhaust Fans

1. EF-1 shall be interlocked with AHU-1. Energize fan when AHU is energized.
2. EF-2 shall be controlled by disconnect. Fan is to be energized at all times.

E. Points List: The BAS shall monitor and display the following points on a unique system graphic:

1. Pump Start/Stop
2. Pump Status (CT or DP)
3. Pump VFD speed output
5. Pump VFD drive fault
6. System water pressure

4.05 AUTOMATIC TEMPERATURE CONTROLS

- A. The controls contractor shall furnish all labor, materials, equipment and services necessary as herein specified and shown in the drawings and written specifications.
- B. The control system shall accommodate simultaneous multiple user operation. There shall be no limit to number of users accessing the system at any time.
- C. System graphics shall be color graphic oriented. Graphics shall be printable via an approved laser printer provided by EMS vendor.
- D. Provide a means of manual controlling analog and binary output points. Control overrides shall be performed through a simple, graphical on-off-auto selection for binary points and an auto-manual selection for analog outputs. Provide an icon indicator of override status when a point, controller, or application has been manually overridden.
- E. Control system vendor shall provide local access to all on-site equipment in a manner identical to workstation features and access. One laptop computer shall be provided with all software for control and modification included (see item M). Software shall be install and fully functional. Licenses shall be provided for all programs.
- F. Vendor will supply spare controllers (2) for AHU, (2) for VAV boxes, (2) for VAV reheat coils for control operation. In House training will be provided on replacing all EMS equipment to full service performance. Vendor shall also supply two sensors of each type used in building system. Close-out documents shall include a signed form from the climate control supervisor that spare parts were delivered and received.
- G. Vendor shall supply "as build" drawing and wiring details. This will include two sets of paper drawings and two digital (CD-ROM or DVD) copies. Program to view, modify, and print drawing shall be provided for workstations and laptop unit.
- H. All wiring shall be permanently marked at both ends and any junction points. Drawings shall be provided as per section I.
- I. A copy of all controls and wiring shall be supplied permanently attached and protected to field service equipment.
- J. Printed manuals (2) shall be included. Manuals shall explain installation of new points, panels, and controllers. Include repair/replacement of all hardware used. Also include programming manual for control software including algorithms, calculations used, point database creation/modification. Include full explanation of any editing software.

SECTION 15980

VARIABLE FREQUENCY DRIVES

980.1 GENERAL

- A. Variable speed drives shall be a solid state motor controller which controls motor speed by varying the output voltage and frequency to the motor controlled. The drives shall be manufactured by Magnetek, Square "D" or Allen Bradley.
- B. Use of silicon controlled rectifiers (SCRs) in the drive output stage is not acceptable.
- C. Manufacturer shall maintain a factory trained technician and parts within 150 mile radius of site.

980.2 ENCLOSURE

- A. The drive shall be enclosed in a wall, or rack mounted NEMA 1 enclosure with forced fan ventilation.
- B. Enclosure finishes shall be corrosion resistant.
- C. Enclosures shall be dead back with mounting suitability for side by side, or back to back mounting.
- D. Component access shall be through a hinged front access door.
- E. The input disconnect circuit breaker shall be interlocked with the access door.

980.3 STANDARD REQUIREMENTS

- A. Input circuit breaker: The breaker shall be fused, sized as required with a minimum interrupting capacity of 25,000 amperes.
- B. Operator indicators and controls - door mounted
 - 1. Provide a manual speed setting dial.
 - 2. Provide a hand-off-auto selector.
 - 3. Provide a start/stop control switch.
 - 4. Provide an integral digital display of operating frequency motor amperes and motor speed.
 - 5. Provide a power on light.
 - 6. Provide an RS-232 communications port for interface with the Energy Management System.
 - 7. Provide a job mode of operation.
 - 8. Provide diagnostics LED view window.
- C. Integral Protection Requirements
 - 1. Provide ground fault protection for both line to line and line to ground type faults.
 - 2. Provide single phase protection.

3. Provide overvoltage, undervoltage and input line transient protection.
4. Provide motor thermal overload protection on the output.
5. Provide ride through for a 2 second loss of input power with no loss of operation.
6. Provide for an overtemperature automatic shutdown.
7. Provide automatic torque limiting for acceleration/deceleration rates.
8. Provide speed search feature for starting the drive into a spinning motor or provide DC injection braking to stop the motor then begin operation in the proper rotation.
9. Provide for auto trip off if regenerative power from motor exceeds maximum voltage acceptable.
10. Provide protection for removal of load without time delay requirements.
11. Provide protection of input power system from drive generated transients in accordance with FCC Regulation Part 15-J-A.
12. Provide torque limiting settable from 25-150 percent of full drive rating to limit speed while maintaining constant V/Hz during overload conditions.
13. Provide automatic default of 50 percent of speed should control signal from energy management system, or controller be rendered inoperative.

D. Remote Controls

1. Provide a 3-20 PSI follower and connection for remote pneumatic system control. Electrical connection or air duct pressure loop controller as required.
2. Provide a manual bypass system for operation through the drive.
3. Provide two (2) sets of auxiliary contacts for remote indicators.
4. Control voltage shall be 120 VAC, 60 Hz.

E. Provide with RFI filter, isolation transformer and enclosure for each drive.

F. Performance Characteristics

1. The input voltage shall be 208 volt, 60 Hertz, 3 phase, at a + 10 percent and -10 percent variation acceptable. Acceptable frequency variation is plus or minus 2 percent.
2. The output voltage shall be 208 volt, 1.5 to 60 Hertz at motor rated current, 100 percent overload, 150 percent breakaway.
3. Output frequency stability shall be .01 percent with a digital reference, or .06 percent with an analog reference.
4. Base speed shall be adjustable 1.5 to 60 hz at constant volts/Hertz.
5. The drive shall be rated at required horsepower for single, motor applications and operate with any standard squirrel cage induction motor within its capacity.
6. Drive efficiency shall be over 95 percent with a service factor of 1.0.

G. Diagnostics: As a minimum the diagnostics shall display the following data: Blown fuse, overcurrent, overload, over temperature, under voltage, external failure and ground fault.

H. Ratings: For a 208 volt input the horsepower of the drives shall be rated at a minimum of the horse power for particular air handler.

980.4 INSTALLATION

- A. The variable frequency drive shall be installed in accordance with the Drawings, the Specifications, and manufacturer's guidelines.

SECTION 15990

TESTING AND BALANCING AIR AND WATER SYSTEMS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

- A. This section specifies the requirements and procedures for the mechanical contractor to support the testing, adjusting, and balancing activities of a separate Test and Balance Contractor (TABV) hired separately by the Commissioning Agent (CxA).
- B. The Owner has hired an independent Commissioning Agent to commission the mechanical and controls system serving this facility.
- C. The commissioning of the systems will be done in accordance with Section 17800.
- D. The Commissioning Agent will hire a Test and Balance Contractor to provide testing and balancing.
- E. Testing and Balancing Contractor (TABC) will be responsible to carry out the commissioning requirements specified in Sections 17800 and other sections referenced in 17800.
- F. The qualifications of the TABC firm shall be submitted, along with the specific qualifications of the lead site technician who will remain on site during all TAB work, within sixty (60) days of notice to proceed. Recent projects shall be listed and described for both the company and the lead technician. Names and telephone numbers of the project contractors and facility managers will be provided.

1.02 SUMMARY

- A. The mechanical contractor has numerous responsibilities associated with the test and balance.
- B. The section does not include:
 - 1. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.

1.03 CODES AND STANDARDS:

- A. Applicable publications: The following publications form a part of this specification, to the extent that they represent minimum standards. Where this specification exceeds these standards, this specification shall be followed.
- B. Associated Air Balance Council (AABC) National Standards or Field Measurement and Instrumentation, latest edition.

- C. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Handbook - Fundamentals, latest edition.
- D. Chapters on Testing, Adjusting, and Balancing of Environmental Systems and Related Subjects, ASHRAE Handbook - Systems, latest edition.
- E. National Environmental Balancing Bureau (NEBB)
- F. Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems, latest edition.
- G. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) HVAC System - Testing, Adjusting and Balancing, latest edition.

PART 2 – PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 THE MECHANICAL CONTRACTOR'S RESPONSIBILITIES:

- A. Furnish the test and balance contractor one complete set of accepted equipment data and one complete set of accepted mechanical shop drawings.
- B. The mechanical contractor shall be responsible for advising the test and balance contractor of any change(s) made to the system(s) during the construction process.
- C. Mechanical contractor shall provide drawings, specifications, shop drawings, control diagrams, etc. detailing the change(s) to the test and balance contractor.
- D. Replace and/or install pulleys, belts and dampers as required for the correct balance as directed by the test and balance contractor.
- E. Allocate time in the construction schedule for test and balance procedure.
- F. Assist the test and balance contractor in coordinating work with the other trades.
- G. Place all systems and necessary allied devices required, and only those required, for each working day of the testing and balancing procedures into "Full Call" operation. At the completion of the testing and balancing procedures for the day, the mechanical contractor shall return the systems to normal operation or shut them down.
- H. Prepare the air side system for testing and balancing as follows, (all new and existing devices are included):
 - 1 Mechanically check all rotating air devices, to insure that the devices are capable of operation under normal design modes and have correct rotation and the related automatic controls are functional and calibrated.

- 2 All balancing, splitter, volume, fire and smoke control, and V.A.V. dampers shall be in their respective neutral position or fully open. All locking devices shall be functional and secured.
- 3 All air distribution inlet and outlet devices (i.e., grilles, registers, diffusers, and etc.) shall be fully open. All locking devices shall be functional and secured.
- 4 All automatic controls (i.e., direct digital, electronic, electric, pneumatic, hydraulic and/or any combination thereof) shall be mechanically and electrically checked and be available to operate under design conditions.
- 5 Air control locking devices (i.e., control rods, quadrants, and etc.) shall be permanently marked to represent the true position of their respective control surfaces. The locking devices markings shall be inconspicuous in occupied areas.
- 6 Install new air filters before the start of testing and as directed by the test and balance contractor in order to meet design conditions of the air handling devices. Provide air control devices, such as balancing dampers, as per the drawings and specifications, and as directed by the test and balance contractor in order to obtain the proper balance conditions.
- 7 Mechanically check variable volume air devices for all operational modes. Verify devices operate, no loose linkage, damper blades, parts move freely as intended.
- 8 TAB fieldwork shall not begin on any system/equipment item until signed construction checklists and startup check lists, pertaining to applicable equipment, have been submitted by the installing contractor to the Commissioning team.
- 9 The TAB Agency shall be provided with either appropriate control system software or the Control Contractor's handheld device for setting the terminal boxes and entering/updating terminal box flow coefficients, and for placing equipment in the correct mode for testing. This software and/or equipment shall be provided to the TAB Agency free of charge for the duration of the project, and shall be returnable to the Controls Contractor upon completion of the project. Providing the Tab Agency laptop software for placing equipment in the proper operating mode for testing, and for entering terminal box flow coefficients, allows the TAB Agency to program the boxes as it completes them, and is the most effective use of both the Temperature Control's Sub Contractor's and TAB Agency's time.

I. Prepare the water side of systems for testing, adjusting, and balancing as follows (all new and existing devices are included):

- 1 Open all balancing and normally open isolation valves to the full open position. Control valves shall be fully open to their coils. Close all bypass valves. All line strainers shall be removed and cleaned prior to start of TAB.
- 2 Check and verify that all manual and automatic air vents, expansion tank and water fill systems are installed and operating properly. Verify that systems are full of water and not air bound.

K. The system(s) operational cost(s), during testing and balancing procedures is the Owner's responsibility.

3.02 TESTING AND BALANCING CONTRACTOR'S RESPONSIBILITIES:

A. During Original Installation:

1. TABC shall make regular visits to the job site during installation of mechanical systems to ensure that work is being installed in a manner and with accessories which will permit satisfactory balancing of the systems.
- B. Notification Required: The Balancing Contractor shall immediately notify the CxA, the Owner's PM and the architect in writing with specific information if the Balancing Contractor believes that additional accessories such as dampers and valves are necessary for proper balancing, and if the Balancing Contractor believes that any work is being installed in a manner which adversely affects proper balancing.
- C. Submit the outline of the TAB plan and approach for each system and component to the CxA, GC and the CC six (6) weeks prior to starting the TAB. This plan will be developed after the TABC has some familiarity with the control system.
- D. Test Policies and Procedures: The Balancing Contractor will make operation and balancing tests only after pressure tests and system cleaning is completed by the MC. Make tests in the presence of the CxA, Owner's PM and project engineers and architect as appropriate. Make CFM and static pressure tests.
- E. Test Equipment: The Balancing Contractor shall provide all test equipment, gages, instruments, and personnel needed to properly complete the tests performed by the Balancing Contractor under the direction of the CxA.
- F. Test Evaluation and Acceptance: The Balancing Contractor shall provide a detailed Balancing Report to the CxA two weeks after completion, refer to Section 17800 additional requirements. This report shall show design conditions and actual measurements. The Balancing Report shall not be a copy of the design documents. The Balancing Report shall be a new report with tables having columns for Room Name and Number, Design Requirement, Measured Value, and Deviation. The Balancing Contractor shall also provide typewritten opinions and evaluation as to whether the installed systems meet design requirements. Acceptance and approval of the installed work, however, shall remain with the project engineer, project architect, and the Owner's PM, and not the Balancing Contractor.
- G. Acceptance Criteria: To be acceptable, design requirements must be met within $\pm 10\%$. In addition to meeting design requirements, the installed work shall operate with the least possible and no objectionable noise or vibration. Quiet and vibration free operation is a contract requirement. Work that does not meet this requirement shall be repaired or replaced at no additional cost to the Owner. Acceptance by Authorities: A contract requirement shall be to provide systems that are acceptable to authorities having jurisdiction. Work that does not meet this requirement shall be repaired or replaced at no additional cost to the Owner.

3.03 GENERAL CONTRACTOR'S RESPONSIBILITIES

- A. The General Contractor and its subcontractors shall cooperate with the Balancing Contractor and shall make all necessary adjustments as recommended by the Balancing Contractor. At no additional cost to the Owner, the General Contractor and its subcontractors shall adjust or replace all impellers, pulleys, sheaves, belts, dampers, and

other work, and shall add dampers as needed for correct system operation and balance. The General Contractor shall sign and date each item on all the punch lists provided by the Balancing Contractor. Punch lists shall be addressed within ten (10) working days of receipt. If any items are indicated as having been completed and the Balancing Contractor returns to find it has not been done, the General Contractor shall pay for all return visits by the Balancing Contractor required because those items are not completed.

DIVISION 16 - ELECTRICAL

16010 GENERAL PROVISIONS

A. Governing Clause

1. For the sake of brevity these specifications shall omit phrases such as "Contractor shall furnish and install", "unless otherwise indicated or specified", etc., but these phrases are nevertheless implied. Mention of materials and operations requires the Contractor to furnish and install such materials and perform such operations to provide a complete and operating system to the satisfaction of the Architect.

B. General Conditions

1. General Conditions, Supplementary General Conditions, Information to Bidders, General Requirements and Alternates and other pertinent documents issued by the Architect are a part of these specifications and shall be complied with in every respect.
2. Notwithstanding any reference in the specifications to any article, device, product, materials, fixture, form, or type of construction by name, make, or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgement of the Architect, expressed in writing, is equal to that specified.
3. This project requires major renovation of existing systems along with additions and modifications. All existing areas and equipment not under modification shall remain in operation. Electrical service shall not be interrupted except with approval of the Architect and interruption shall occur at the convenience of the Owner with proper advance notification. This may require week-end and night work.
4. Where new work or demolition affects existing electrical equipment and/or circuitry which will remain, the equipment shall be removed, relocated as required, and recircuited in accord with these specifications. Any necessary temporary relocation, as determined by the Architect, shall be done at no extra cost and in a safe and secure manner.
5. Demolition of existing equipment noted or required by the new work shall consist of removal of equipment, removal of exposed conduit, removal of wiring back to next in line junction or over-current protection and re-connection and/or rerouting of feed-thru circuits. All equipment removed shall remain the property of the Owner unless the Contractor is otherwise instructed in which case it shall be removed from the site by the Contractor.
6. Prior to beginning work, Contractor shall note (in writing to the Architect) any deficiencies in the existing systems that are to be modified by this project. This shall be used to determine the final operating condition of systems at the completion of this project.

C. Record Drawings

1. The contractor shall provide the Architect at job acceptance the following:
 - a. Two (2) sets of blue line prints of same scale as original drawings marked in red showing all variations of the work actually installed related to the original drawings. This set of drawings shall include all, addenda, approved and installed change orders, field condition changes, and other departures from the original plans and specifications.
 - b. Three (3) sets of shop drawings and other data required by the specifications reflecting the manufacturer's shop fabrication of the materials actually installed. The Division 16 shop drawings shall be separately post bound, indexed, and tabbed by specification section. Faxed or copies of faxed material shall not be used in Close-Out Documents.
 - c. Operation and maintenance manuals and manufacturer's instructions.

D. Tests and Observations

1. The complete job shall be, during and/or after construction, subject to the tests and observations as herein described and as noted on the drawings. Deficiencies found as a result of these tests and observations shall be corrected by the Contractor within a reasonable period and at no expense to the Owner.
2. By Architect's observations and tests conducted by him or for him in his presence. Upon notice, Contractor shall furnish not to exceed two men, one to include the job foreman, and tools to assist and be directed by the Architect for a reasonable amount of time to make such tests and observations as are requested by the Architect.
3. Conductor insulation tests shall be performed in the Architect's presence and shall be subject to his approval. A written report of these tests shall be submitted to the Architect for approval prior to acceptance.

600-Volt Conductor: Using a 500-volt megger, each circuit conductor shall be tested with all splices made but no equipment connected. The ohmic value shall be recorded and results must meet minimum requirements as follows:

<u>Wire Size</u>	<u>Kilohms</u>
#12	1000
#10-#8	250
#6-#3	100
#2-#3/0	50
#4/0-500 MCM	25
750 MCM	12

- (1) Feeders with paralleled conductors shall have conductors tested separately prior to paralleling.

- (2) Conductors not meeting these minimum values shall be repaired or replaced as directed by the Architect.

Above 600-Volt Conductor: After each section of cable is installed with all splices and/or terminations made, but not connected to equipment, acceptance test shall be made using an approved high voltage DC tester. Test shall be conducted in accordance with latest I.C.E.A. recommended practice. Results shall meet the requirements of the cable manufacturer. Test report shall include all test values, graphic representation of test, and test ambient conditions. This test shall be conducted by a professional engineer registered in the State of Mississippi and not in the regular employ of the Contractor. Approval of personnel and equipment shall be subject to the approval of the Architect.

4. By any Federal, State and/or local authority.
5. By the Owner's Insurance Carrier. After inspection by this agency, Contractor shall make corrections of any deficiencies found adversely affecting the insurance to be carried by the Owner. Acceptance of the Owner's Insurance Carrier's report or subsequent reports lie with the Architect or Owner.
6. Ground Rod Tests: Before any wire is connected to the ground rods, each rod shall be tested for resistance to ground. A direct reading, single test, portable ground-testing megger shall be used to test each ground rod. The auxiliary or reference ground rods shall be 3/4-inch copper clad steel, not less than 4 feet in length and driven 3-1/2 feet deep, and shall be installed in a straight line, a minimum of 20 feet from the ground being tested. No. #14 AWG stranded wire leads with high grade rubber insulation shall be connected to the rod being tested and the two reference rods and to the proper binding post on the instrument. Where there is more than one ground rod within a circle of 10 feet at a particular location, the reference rods as driven for the "first" test shall be used for tests on the other rods without changing their location. A pointer shall indicate the resistance to earth in ohms and fraction of ohms of the ground rod being tested. Tests shall not be made within 48 hours after rainfall nor during foggy weather. Should the ground resistance exceed 25 ohms, the Contractor shall install additional rods as necessary until the overall resistance is reduced to 25 ohms or below. Test results shall be recorded, including ambient conditions, and submitted to the Architect for approval.
7. Special Systems Test: The systems covered by Sections 16600 "Special Systems" shall be tested for proper operation after complete installation in accord with the manufacturer's recommendations, applicable codes and test guidelines as detailed in the appropriate system's specifications. The testing shall be done by an independent, third-party company qualified to test the system involved. Testing company qualifications shall be submitted to the Architect and must be approved by the Architect before testing begins.

A full report of test results as outlined in the associated system specifications shall be submitted to the Architect in writing prior to substantial completion. Where system(s) operations involve other Divisions of the Specifications, the affected Professional shall verify by signed statement that the operation was correct and complete. Retesting as necessary to achieve a completed report(s) shall be required. The Architect will perform random component testing at substantial completion. Should the system(s) not perform correctly, a complete re-test can be required with no increase in cost to the Owner. If more than one re-check by the Architect is required to verify proper system(s) operation, the Contractor will be billed for the time and expense of the Architect.

E. Guarantee

1. Guarantee to the Owner all work performed under this contract to be free from defects in workmanship and materials for a period of one year from date of final acceptance by the Architect and the Owner except as hereinafter noted.
 - a. Remedy within a reasonable period any defects arising during this period at his own expense upon notice of the Owner or his authorized representative.
 - b. Lamps are hereby exempt from a one-year guarantee as follows:
 - (1) All lamps are to be operating upon acceptance of the job.
 - (2) All incandescent lamp burn-outs occurring during the first thirty (30) days after final acceptance shall be reported to the Architect at the end of this thirty-day period. Replacements for these burn-outs shall be furnished and installed by the Contractor upon notice from the Architect.
 - (3) All gaseous vapor discharge lamp burn-outs occurring during the first one-hundred eighty (180) days after final acceptance shall be reported to the Architect at the end of this one hundred eighty-day period. Replacements for these burn-outs shall be furnished and installed by the Contractor upon notice from the Architect.

- END OF SECTION 16010 -

16020 CODES AND STANDARDS

A. Codes

1. Strictly comply with the latest edition of the National Electrical Code (NEC), National Fire Protection Association (NFPA), International Building Code (IBC), National Electrical Safety Code (ANSI-C2) and all Federal, State and/or local codes. Notify Architect of any conflict between these codes and the drawings and/or specifications before bid date or correct conflicts at his own expense.

B. Standards

1. Familiarize himself, coordinate, and cooperate with all other trades in installation of his materials. Layout of Division 16 work shall be the responsibility of this Contractor and all conflicts with Division 16 work and other trades shall be resolved prior to installation.
2. Use only new equipment/materials of current manufacturer which are listed by Underwriters' Laboratories when such listings are issued for the type of equipment/materials, approved by NEMA standards, National Electrical Code standards or other appropriate agency. Equipment/material shall be of current production from manufacturer's of long experience in the manufacturer of such type equipment/material and who are regularly engaged in the production of this type equipment/material.
3. Equipment/materials shall have local service representation where applicable.
4. Notify Architect prior to installation of conflicts between electrical and structural, architectural, mechanical, etc. work.
5. Equipment/materials installed and connected in strict compliance with manufacturer's recommendations unless these requirements are exceeded as noted on the drawings or specified herein.
6. Equipment/materials shall be installed and connected in a neat and workmanlike manner.
7. Use experienced labor or employ appropriate Sub-Contractor to do all cutting and patching necessary for installation of his materials. Obtain permission from Architect and General Contractor before cutting any structural member.
8. Not to scale electrical drawings. Follow architectural, equipment supplier shop drawings, and manufacturers shop and installation drawings for accuracy.

- END OF SECTION 16020 -

16030 ELECTRICAL SYSTEMS SCHEDULE

A. Systems

1. All electrical materials and operations for complete and operative systems as follows:

Primary electrical distribution system

Metering system

Secondary electrical distribution system

Emergency engine generator & control system

Power outlets and connections to all motors and equipment.

Lighting system complete with controls and fixtures.

Programmable lighting controllers.

Telephone outlets and conduits.

Data outlets & conduits.

Fire alarm and detection system

Dimming and control system

Security/Access Control provisions.

Miscellaneous as shown on the drawings and as stated herein.

- END OF SECTION 16030 -

16100 BASIC MATERIALS AND METHODS

A. General

1. Equipment is specified by manufacturer's name and catalog number and is intended to establish the minimum standards of quality acceptable.
2. Substitute equipment, equivalent in all respects to that specified, is permitted with the written approval of the Architect. Approval will not be considered until after award of contract and only if submitted by the Contractor.
3. The manufacturer's name first mentioned in this specification is considered to be the specified equipment. The "or equal" manufacturer's mentioned or other manufacturers proposed by the Contractor shall be considered as substituted equipment.
4. Substituted equipment shall meet the dimensional and functional requirements of the building as represented by the plans and specifications. All revisions to the contract precipitated by the use of substituted equipment shall be incorporated by the Contractor, after approval in writing by the Architect, at no additional cost to the Owner.
5. Architect's approval of shop drawings does not relieve the Contractor from satisfying the requirements of the drawings and specifications. Any equipment or work found in the judgment of the Architect to be defective or otherwise unsuitable shall be repaired or replaced by the Contractor at no additional cost to the Owner.
6. If requested in writing by the Architect, the Contractor shall submit a scale drawing (scale as directed by Architect) of any electrical equipment area, conduit layout, or the like which in the opinion of the Architect may present difficulty regarding space allocation or clearances.
7. Mounting Heights
 - a. Mounting heights of various devices, outlets, safety switches, panelboards and the like shall reference the height above the finished floor or grade above which they are mounted. Heights specified shall reference the center of the device, box, breaker or switch operating handle.
 - b. Mounting heights may be adjusted slightly to permit cutting of masonry block to the top or bottom of the block course nearest the required height. All heights shall be consistently cut above or below block coursing so that they will be the same height above the reference.

c. Mounting heights shall be as follows:

<u>Description</u>	<u>Mounting Height</u>
Switch Toggle	48" to center
Receptacle	16" to center
Safety Switch	54" to center
Panelboard	78" to top breaker
Enclosed Circuit Breakers	54" to center
Receptacle or Switch above counter top	4" to center above counter / backsplash
Fire Alarm System Audio/Visual Device	80" to center or 6" below ceiling, whichever lower
Fire alarm System Visual Device	80" to center or 6" below ceiling, whichever lower
Fire Alarm system Manual Station	48" to center

B. Instructions

1. After the project notice to proceed has been issued and with promptness to assure reasonable time for review with no delay to the project, the Contractor shall submit to the Professional a minimum of six (6) copies of shop drawings for all equipment and material for the electrical systems for approval whether or not substituted equipment or materials.
2. Shop drawings shall be post-bound, indexed and tabbed per the appropriate specification sections. All material/equipment shop drawing cut sheets shall be properly located under the appropriate specification section. All shop drawings shall be originals (no faxed copies) and shall be readable without being removed from the bindings. All information listed on the shop drawings shall be typed. Handwritten information will not be accepted.
3. All submitted equipment/material and associated options, accessories, special features, etc. shall be clearly marked and indicated on all copies of the shop drawings. Provide appropriate shop drawings on all required accessory equipment.
4. All shop drawings for all systems, equipment and materials including any required one-line drawings, diagrams, etc. shall be submitted together. Partial submittals will not be reviewed without prior consent. Special systems provided by specialized vendors or distributors may be submitted in a separate binder.
5. Provide complete shop drawings with all pertinent information for the following equipment and/or systems and all required components:

Pad-mounted transformers

Pad-mounted primary switches.

Meters

Current transformers

Switchboards

Panelboards

Dimming and control system components

Dry type transformers

Transient voltage surge suppression (TVSS) device(s)

Engine generator

Transfer switch

Conduit and other raceways

Cable tray

Wire and cable

Required cable test reports

Wiring devices

Lighting fixtures

Lamps

Fire alarm and detection system components

- a. All shop drawings including one-line diagrams shall be submitted together. Partial submittals will not be reviewed without prior consent.

- END OF SECTION 16100 -

16110 RACEWAYS AND FITTINGS

A. Instructions (Metallic Raceways)

1. All wiring in hot-dipped galvanized rigid steel (GRS) conduit (UL 6), intermediate conduit (IMC) (UL 1242), or electrical metallic tubing (EMT) (UL 797) unless specifically shown otherwise on the drawings or stated herein. Conduit in accordance with the following schedule:
 - a. In any poured concrete: Hot-dipped galvanized rigid steel conduit or IMC.
 - b. In masonry walls: Hot-dipped galvanized rigid steel conduit, IMC or EMT.
 - c. In suspended ceiling construction or non-masonry partitions: Hot-dipped galvanized rigid steel conduit, IMC or EMT.
 - d. In exposed locations indoors: Hot-dipped galvanized rigid steel conduit, IMC or EMT.
 - e. In exposed locations out of doors. Hot-dipped galvanized rigid steel conduit or IMC. All conduits in earth shall be hot-dipped galvanized rigid steel coated with polyvinyl, polyethylene or asphaltum. Conduits installed in earth shall be buried a minimum of 24" to top below finished grade.
 - f. All feeders shall be run in hot-dipped galvanized rigid steel conduit or IMC. Feeder routing shall follow shortest route possible within other requirements herein specified.
 - g. Conduit in excess of 1-1/4" trade size shall be hot-dipped galvanized rigid steel conduit or IMC.
2. Size conduits as shown on the drawings or where size not shown follow National Electrical Code. Four-wire branch circuit homeruns shall be 3/4" trade size minimum. Homeruns shall not exceed the number of conductors shown on the drawings unless specific approval is given by the Architect.
3. Conceal all conduits not shown exposed on drawings. Conceal all conduits in partitions unless specifically shown otherwise on drawings or stated herein.
4. Where conduits are shown concealed in concrete slabs in contact with earth, conduits 1/2" through 1-1/4" trade size shall be installed in and not under slabs. Conduits in excess of 1-1/4" trade size shall be installed under slab and shall have two coats of asphaltum paint applied or shall be coated with polyvinyl, polyethylene or other approved coatings. Where conduit symbol indicates conduit concealed in floor slab and concrete thickness is less than four (4) inches, conduits shall be installed below slab. Conduits shall be routed as required so as not to compromise the structural integrity of any concrete.

5. Run conduits parallel and/or perpendicular to walls, ceilings or floors. Homerun conduits shall be combined to form a common routing path and supported from the building structure by trapeze style hangers.
6. Couple conduits together and connect to boxes, fittings and cabinets so as to provide effective electrical continuity. Do not use couplings dependent on screws bearing on conduit.
7. Provide insulating bushing for all conduits. Bushings to be OZ type "BLG", Steel City, Thomas and Betts or equal approved by the Architect.
8. Conduits shall not be routed horizontally on roof without specific approval from Architect. All roof penetrations shall be weatherproofed by Division 7 Contractor. Division 16 Contractor shall be responsible for procuring and coordinating with Division 7 Contractor to perform roof penetrations.
9. Make field bends in conduits in accordance with table in Article 346 of the National Electrical Code.
10. Plug upturned conduits to prevent entrance of moisture or debris and make certain that conduits are clear of same before pulling in wire.
11. Use not to exceed six (6) feet of flexible metal conduit for connection to motors and/or recessed fixtures unless otherwise specified herein. Flexible conduit shall be steel. Flexible conduit used for connections subject to moisture under normal conditions or where specifically indicated or noted shall be liquid tight with proper liquid tight fittings. All flexible conduit shall have properly sized bonding jumper installed within and shall be sized in accordance with Article 250, Table 250-95 of the National Electrical Code.
12. All final connections to motors, transformers or other vibrating equipment shall be with liquid tight flexible conduit.
13. Amply support conduits in accordance with the NEC and as follows:
 - a. By one-hole or two-hole straps.
 - b. By at least three rounds of #14 B & S gauge galvanized wire twisted around concrete reinforcing rods.
 - c. By one- or two-hole malleable iron clamps for exposed work held in place by machine screws in expanding lead anchors in concrete or masonry or by screws in wood.
 - d. By conduit clamps for bar joists.
 - e. Where groups of conduit occur or for feeder conduits where applicable, by trapeze hangers adequately supported by steel rods attached to concrete inserts, welded supports, bolted supports, etc.

- f. Bulb "T" clamps for conduits crossing bulb "T"s.
- 14. Pull one (1) nylon pull string, minimum 1/8" diameter, into all empty conduits.
- 15. Openings around electrical penetrations through smoke-stop or fire-resistant rated walls, partitions, floors or ceilings shall be smoke and/or fire-stopped using approved UL listed system designed for the materials encountered to maintain the smoke-stop and/or fire-resistant rating.
- 16. Expansion fittings in conduits where shown on the drawings or where passing through expansion joints imbedded in concrete. Fittings shall be Crouse-Hinds type XJ complete with type GC100 grounding strap and type GC102 strap clamps or approved equal in Killark or Appleton.
- 17. Provide seal-off fittings where shown on the drawings or as required by a condition encountered requiring a seal. Seals shall be installed where conduits are installed between areas of different temperatures where condensation may occur. These shall include, but not be limited to, refrigerators, freezers, air-handling units, environmental rooms and building exterior. Seals shall also be installed where conduits enter the building or a piece of equipment and there is a possibility of moisture migration thru the raceway to the equipment or into the building. Fittings shall be Crouse-Hinds type EYS for horizontal and vertical runs, or type EYS elbow seals or approved equal in Killark or Appleton. All seals shall be properly installed using "Chico X" fiber and "Chico A" sealing compound.
- 18. Assure ground continuity on feeder and branch circuits as stipulated in Article 250 of NEC by two locknuts, one inside and one outside of all boxes, cabinets and gutters.
- 19. Wiring gutters shall not be used unless specifically shown or noted on the drawings.
- 20. Conduit Fittings
 - a. All conduit fittings shall be of steel or malleable iron. Die cast fittings are not acceptable.
 - b. Rigid Steel and IMC Conduit Fittings:
 - (1) Standard steel or malleable iron threaded couplings, locknuts, bushings, and elbows.
 - (2) Locknuts: Bonding type of steel or malleable iron with sharp edges for digging into the metal wall of an enclosure.
 - (3) Bushings: Insulating type of steel or malleable iron consisting of an insulating insert molded or locked into the metallic body of the fitting. Grounding type with ground lug.
 - c. EMT Conduit Fittings:
 - (1) Couplings and connectors shall be indentor type or compression type of steel or

malleable iron as manufactured by T&B, Appleton or equal. Indentor type shall be secured to each conduit with two operations of tool at right angles.

B. Instructions (Non-metallic Raceways)

1. Where specifically noted and/or indicated on the drawings, wiring may be installed in PVC conduit. PVC conduit shall be electrical grade Schedule 40 as manufactured by Carlon, Triangle, PWC or equal approved by Architect.
2. Installation shall follow the applicable provisions of paragraph 16110 "RACEWAYS AND FITTINGS" hereinbefore specified and manufacturer's recommendation unless exceeded by requirements shown on the drawings. All joints shall be made using approved solvent cement.
3. Where used for service conductors and where noted on the drawings, conduits shall be concrete-encased with a minimum of 3" coverage on all sides.
4. Rigid steel conduit shall be used where PVC conduits turn angles and/or are exposed.
5. PVC conduit shall not be stored nor have been stored in direct sunlight.
6. PVC boxes of equivalent dimension to those hereinafter specified under paragraph 16160 "BOXES AND FITTINGS" shall be used with PVC box connectors.
7. Where underground PVC conduits are shown and/or noted on the drawings to be used for communication systems and/or to be empty for future use, provide one #8 copper conductor in each conduit for full length of conduit for future locating purposes.

C. Instructions (Raceway Concrete Encasement)

1. Raceway concrete encasement where called for on the drawings and/or these specifications shall be poured in a single continuous pour or all joints shall have plywood vertical dam at each pour joint with #6 bars 4'-0" into each pour. Pour joint shall not occur at conduit couplings, angles, etc. Bars shall be 6 inches on center with 3 inches concrete cover around perimeter of raceway duct bank.

D. Instructions (Cable Tray)

1. Where shown or noted on the drawings, cable tray shall be provided and installed.
2. Cable tray shall be aluminum, 12" wide, 4" load depth, ladder type NEMA Class 12A as manufactured by Square D Company Class 5160, MP Husky, Walker or approved equal.
3. Cable tray shall be installed above accessible ceilings in compliance with manufacturer's requirements and N.E.C. unless exceeded by requirements noted herein or on the drawings and shall be complete with all mounting and fitting accessories.
4. Cable tray shall be anchored to the building structure with suitable fasteners located within

6" of any offset and a maximum of 10' on center in between. Fasteners shall be anchored with strongest method available in keeping with the architectural finish encountered and must support the allowable loading weight per foot of the cable tray as defined in the NEMA Class and support spacing.

5. Where cable tray(s) penetrate smoke-stop or fire-resistant rated walls, partitions, floors or ceilings, provide proper smoke and/or fire stop using approved UL listed system designed for the materials and situations encountered to maintain the smoke-stop and/or fire-resistant rating.
6. Route to avoid piping and ducts and maintain at least one side of cable tray clear for access. Fully coordinate with all other trades prior to rough-in and adjust routing as necessary.
7. Furnish with shop drawings a complete tray layout, each floor, showing full routing. Layout to include all major obstructions and sufficient section details to verify dimensions. Fully coordinate with all other trades prior to making layout and adjust routing as necessary.

- END OF SECTION 16110 -

16130 CONDUCTORS

A. Instructions (600 Volts)

1. Conductors shall be standard annealed copper rated 600 volts with mechanical strength, insulation, temperature and carrying capacity adequate for the particular conditions under which they are used and in accordance with the following:
 - a. In wet or dry locations type "THWN" unless shown on drawings or specified herein to be other type.
 - b. In unwired fixtures where required by National Electrical Code, use approved heat-resistant wire sized for current, voltage and temperature at which fixture operates.
 - c. Branch circuit conductors within 3 inches of a ballast within the ballast compartment of fluorescent fixtures shall be recognized for use at temperatures not lower than 90°C. Asbestos wire shall not be used for this application.
 - d. Conductors entering the self-contained ballast compartment of gaseous vapor discharge fixtures shall be rated 600 volts, silicone rubber, fixture wire, #10 AWG, stranded copper conductor, silicone rubber insulation, glass outer-braid, 200°C. rated conductor temperature.
2. Wire sizes #8 AWG and larger shall be of the stranded type, Class B stranding, and sizes #10 AWG and smaller shall be of the solid type with the exception that all final connections to motors or other vibrating equipment shall be made with stranded wire regardless of size.
3. Use approved lubricants which are non-injurious to insulation when pulling conductors into raceways.
4. Use #12 AWG minimum wire size with exceptions as noted on the drawings or as stated herein. Homeruns of 20 ampere circuits in excess of 50 feet shall be #10 AWG minimum size even if not shown on the drawings.
5. Use stranded conductors for final connections to motors and all vibrating equipment.
6. The following conductor color coding shall be observed:

208Y/120 Volts, three phase, four wire, wye connected

 - a. Phase A - Black.
 - b. Phase B - Red.
 - c. Phase C - Blue
 - d. Three way and four way travelers - Yellow.

- e. Neutral - White.
- f. Equipment ground - Green.
- B. Splices and Connections (600 Volt)
 - 1. Make splices and connections in accessible boxes, gutters or cabinets only. Wire sizes #8 and larger to be spliced only with specific approval of Architect.
 - 2. Use soldered and taped or approved mechanical splice connections on solid wire and pressure type solderless connectors well-taped on stranded conductors. Wire sizes #8 and larger to have irreversible compression-type splice.
 - 3. Use Scotch 3M or approved equal plastic tape over mechanical and/or soldered splices applied in thickness equal to wire insulation.
- C. Instructions (Above 600 Volt)
 - 1. Cable shall be single conductor Class B stranded copper with AWG size and voltage as noted on the drawings as manufactured by Rome, General Cable, Cablec Corp., or equal approved by Architect. Cable shall be rated 90°C. conductor temperature.
 - 2. Thermosetting, light and heat stabilized ethylene-propylene, shielded meeting ICEA - NEMA Standard S-68-516, latest edition.
 - 3. Cables shall be completely installed, terminated and tested in accord with Section 16010, "Tests and Inspections" prior to application of service voltage.
 - 4. The cable shall be delivered to the site on the factory reel and the final factory test results shall be submitted to the Architect. Cable shall be installed in the duct or otherwise as noted on the drawings using proper equipment intended for this purpose having automatic tension release so maximum pulling tension of cable will not be exceeded.
- D. Splices and Terminations (Above 600 volts)
 - 1. All terminations and splices shall be made by a cable splicer having not less than five years experience in terminating and splicing cables of the type encountered and who has made a successful splice or termination within the past six (6) months.

2. Splices: No cables shall be spliced unless specifically noted on the drawings or with written approval of the Architect. Cable splices where approved shall be compression type made in strict accord with splice drawings engineered by the splice material manufacturer. Splice materials shall be as recommended by both the cable and splice material manufacturers and shall be the type recommended for the ambient conditions encountered. All field-applied insulation shall maintain the cable's ungrounded neutral level rating. Splice material manufacturer shall be Raychem type HVS, 3M Company, Elastimold, G&W or equal approved by Architect.
3. Terminations: All cables shall be properly terminated in accord with manufacturer's recommendations and all terminations shall be protected from accidental contact, deterioration of coverings, contamination, and moisture in accordance with the NEC. Materials used shall comply with the cable manufacturer's requirements. Terminations shall be as follows:

Potheads shall be provided for all outdoor terminations and those subject to direct rain unless otherwise indicated on the drawings or herein specified. Potheads shall have the next higher standard voltage rating as the cable on which installed. They shall be the product of one manufacturer and shall conform to the requirements of IEEE, Standard for Potheads, Publication No. 48. The manufacturer shall furnish all components, including complete instructions which shall be followed for assembly and installation suitable for the type and material of the cable terminated. The pothead shall consist of a porcelain insulator, top cap, conductor connector, aerial lug, metal body and proper support bracket for installation where indicated, sealed cable entrance and support, insulating compound, and stress relief for shielded cable. Potheads for mounting on conduit shall be the stuffing box type with conduit coupling and means for securing and sealing the cable. Manufacturer shall be G&W Capnot, Slipon II or Slipon (as appropriate for the type of cable), Joslyn, 3M Company or equal approved by Architect.

Terminating kits shall be used for all indoor terminations unless otherwise indicated on the drawings or herein specified. Kits shall have same voltage rating as the specified cable. They shall be the product of one manufacturer and shall include all components with complete instructions which shall be followed for assembly and installation suitable for the type and material of the cable terminated. They shall include stress relief, mounting bracket, and terminal lug. Terminations made inside of high voltage compartments of transformers, switchgear, and other similar enclosures shall be provided with skirts and all terminal kits shall meet the requirements of IEEE Publication #48. Manufacturers shall be 3M Company type QT-III (as appropriate for the type of cable), Raychem type HVT or equal approved by Architect.

Preformed kits specifically intended for URD cable complete with detailed assembly and installation instructions. Kits shall be Elastimold Cat. No. 16THG, RTE or equal approved by Architect.

- END OF SECTION 16130 -

16160 BOXES AND FITTINGS

A. Installation Procedures

1. Only galvanized stamped steel boxes and covers.
2. Bar hangers or other approved structural supports for all boxes and a 3/8" steel fixture stud if required by the fixture type.
3. Close all unused knockout holes and install galvanized blank covers on surface boxes and stainless steel covers on flush boxes having no fixture or device.
4. Mount boxes flush to surface. Install plaster rings or special square corner raised covers for tile or block walls so that fixtures or devices will be perfectly flush mounted. Outlet boxes shall not be installed back to back. Boxes shall not be installed more than 1/4" behind finish face of wall. Boxes installed in masonry walls shall be embedded in masonry.
5. Location of outlets is approximate unless dimensioned. See architectural or shop drawings for greater accuracy. Any box may be moved up to ten (10) feet by direction of the Architect if so directed before box has been installed.
6. Junction or pull boxes as required by field conditions whether or not shown on the plans. Use Columbia screw cover pull boxes indoors and Hope cast iron boxes out of doors or approved equal. Consult Architect for size and locations. All junction or pull boxes shall be labeled with plastic impression tape indicating system being served, feeder and/or circuit number(s). Junction or pull boxes for fire alarm system(s) shall be painted "red" in color.
7. Use boxes in accordance with the following schedule and/or in accordance with Article 370 of the National Electrical Code (table below based on use of #12 AWG) whichever is the larger box required.:
 - a. Switch box, 3" x 2" x 2 1/2", 5 conductors.
 - b. 4" octagon box, 1-1/2" depth, 6 conductors.
 - c. 4" square box, 1-1/2" depth, 9 conductors.
 - d. 4" square box, 2-1/8" depth, 13 conductors.
 - e. 4-11/16" square, 2-1/8" depth, 18 conductors.
8. Watertight junction boxes with hubs in outdoor or damp locations.
9. Boxes as manufactured by Steel City, Appleton, Raco or approved equal.
 - a. Suspended ceiling or wall outlet: 4" octagon X 1-1/2" depth, cat. no. 54151.
 - b. Suspended ceiling or wall outlet: 4" square x 1-1/2" depth, cat. no. 52151.

- c. Suspended ceiling or wall outlet: 4" square x 2-1/8" depth, cat. no. 52171.
 - d. Suspended ceiling or wall outlet: 4-11/16" square x 2-1/8" depth, cat. no. 72171.
 - e. Switch box: 2-1/2" depth cat. no. CL.
 - f. 4" octagon concrete box, depth as required: Cat. no. 54500 Series with CBP plate and stud.
10. Floor boxes shall be as manufactured by Steel City or equal in Hubbell with configuration as shown or noted on the drawings and of proper depth for situation encountered.
- a. Floor boxes to be cast iron with aluminum trim unless otherwise noted, of proper depth for the floor construction encountered and complete with all required accessories for mounting.
 - b. Floor boxes shall be GAB-6 with AFP series receptacle face plate and AFD series communication face plate stamped with proper configuration for communication outlet(s) as directed by Architect or as required by drawings. Floor boxes shall be provided with carpet/tile plate AFM-6-(BRN)(GRY)(BGE).
 - c. All floor boxes where installed flush with floor finish or in carpeted area shall have proper flange to cover joint between edge of box and floor finish. Where installed in other floor finish areas such as wood or concrete they shall have finish plate as recommended by manufacturer. All boxes shall be adjustable after installation to level to finished floor.
- B. Plates
- 1. Plates and/or covers on all boxes and outlets with or without devices. Plates to have all corners in contact with finish wall and shall be horizontal and/or vertical to building surfaces.
 - 2. Plates as manufactured by Hubbell, Pass and Seymour, Arrow Hart, or Leviton shall be stainless steel, satin finish, Type 302, 8% nickel -18% chrome on all flush outlets.
 - 3. All surface outlets shall have galvanized plates.
 - 4. Certain plates designated by symbols on the drawings shall have engraved red legend reading "Emergency". Minimum 1/8" high lettering.

- END OF SECTION 16160 -

16200 ELECTRICAL SERVICE SYSTEM

A. General

1. Secondary Electrical Service

- a. Shall be 480/277 volts, three phase, 4 wire, 60 HZ, wye connected.
- b. Service entrance conduit shall have proper length of tail-wire protruding from approved service entrance fitting for connection to the service facilities.
- c. Verify the service voltage and service entrance requirements with the Utility Company prior to any rough-in or material purchase and notify the Architect of any required changes. Failure to adhere to this requirement shall make this Contractor responsible for correction.

2. Primary Electrical Service

- a. Shall consist of some demolition work and modifications to connect to the existing 13.8 KV System. This is accomplished by installing a new underground primary service and connecting to the existing primary distribution per the drawings.
- b. Any electrical outages that are required for this work shall be planned with the Owner and Architect in advance and shall be kept to a minimum duration. Outages shall be planned for non-business hours and/or weekends unless approved otherwise. Work during any of these times shall not require any additional compensation.

B. Products

1. Primary Service

2. Pad Mounted Transformer:

a. General

- (1) Equipment shall be in accordance with ANSI, IEEE, NEMA, NEC, as shown on the drawings, and as hereinafter specified.
- (2) Ratings are not to be less than shown on the drawings.
- (3) Provide unit designed to withstand the mechanical stresses caused by rough handling during shipment in addition to the electrical and mechanical stresses which occur during operation.
- (4) Completely fabricate unit at the factory so that only the external cable connections are required at the job site.

- (5) Thoroughly clean, phosphatize and finish all the metal surfaces at the factory with a rust-resistant primer and dark green enamel finish coat. All surfaces of the unit to be in contact with the concrete pad shall be treated with corrosion-resistant compounds and epoxy resin, or a rubberized sealing compound.
 - (6) Manufacturer shall be G. E., Howard Ind., Cooper Power Systems, Square D. Co., Vantran or equal approved by Engineer.
- b. Compartments:
- (1) Construction:
 - (a) The high and low voltage compartments and the transformer compartment shall be fabricated by a single manufacturer. The compartments and the transformer tank shall be assembled as an integral unit by a single manufacturer.
 - (b) Separate the high and low voltage compartments with a steel barrier.
 - (c) Construct the compartments of sheet steel of sufficient gage to meet ANSI requirements, with bracing, reinforcing gussetts and jig-welding to assure rectangular rigidity.
 - (d) Use cadmium or zinc plated bolts, nuts, and washers.
 - (e) Provide sufficient space for equipment, cabling, and terminations in the compartments.
 - (f) Permanently affix the transformer instruction nameplate to the unit within the low voltage compartment. Voltage ratings, KVA, connection configuration, impedance, and serial number shall be shown on the nameplate.
 - (2) Doors:
 - (a) Provide a separate door for each compartment with provisions for a single padlock to secure the compartment area. The high voltage compartment door shall be prevented mechanically from opening, unless the low voltage door is opened.
 - (b) The secondary compartment door shall have a one piece steel handle and incorporate three-point locking mechanisms to assure a secure and tight door closing. Provide each compartment door with open-position door stops and tamperproof hinges. The hinge assembly shall be made of corrosion-resistant material welded in place.
 - (c) Provide a 2-inch size padlock for each assembly as approved by the Engineer. Padlocks shall be keyed to the Engineer's established key set. Firmly attached the padlock to the door assembly as required by the Owner.

c. BIL Rating:

- (1) 15 KV class equipment shall have a minimum 95 KV BIL rating.

d. Dead Front Construction

- (1) No exposed live parts, including the cable terminations, shall be accessible within the high voltage compartment.
- (2) Provide a parking stand for each cable that terminates within the high voltage compartment.

e. Primary Switches

- (1) The transformer primary four position, T-blade, selector switch shall be oil-immersed, internal, gang-operated, load break interrupters for a feed-thru transformer. Rating shall be 200 amperes with close-in on fault duty of 5,000 amperes symmetrical at 15 KV. The switch or switches shall be hot stick operated, and have the following selections:

<u>Position</u>	<u>Source A</u>	<u>Source B</u>	<u>Transformer</u>
1	X	O	X
2	O	O	O
3	O	X	X
4	X	X	X

X denotes connected
O denotes disconnected

f. High Voltage Preformed Terminations

- (1) Terminate the high voltage cables in the high voltage compartment with load break premolded rubber elbow connectors. Elbow connectors shall have a minimum of 0.125 inch semi-conductive shield material covering the housing. Test each rubber part prior to shipment from the factory.
- (2) Ground metallic cable shields with a device designed for the purpose. It shall consist of a solderless connector enclosed in watertight rubber housing covering the entire assembly. The grounding device and elbow connector are to be the same manufacturer to insure electrical integrity of shielded parts.
- (3) Premolded parts shall be suitable for submersible applications.
- (4) Elbow connectors shall be as manufactured by RTE (or as accepted) and rated as follows:
 - (a) Voltage: 14.4 KV phase-to-phase.

- (b) BIL: 95 KV.
- (c) AC withstand: 34 KV, 60 Hz for 1 minute.
- (d) DC withstand: 65 KV (field test rating).
- (e) Corona voltage: 11 KV minimum.
- (f) Continuous current: 200 amperes RMS.
- (g) Short time current: 10,000 amperes for 12 cycles.
- (h) Fault closure: 10,000 amperes RMS symmetrical for 10 cycles (after 10 voltage).
- (i) Switching: 10 load-make/load-break operations at 200 amperes, 70-80 percent power factor, 14.4 KV maximum recovery voltage between contacts.
- (5) Interchangeability: The separable connector system shall include the loadbreak elbow, the bushing insert, and bushing well. Separable connectors shall comply with the requirements of ANSI C119.2, and shall be interchangeable between suppliers. Provide the loadbreak elbow and the bushing insert from the same manufacturer.
- (6) Allow sufficient slack in high voltage cable, ground, and drain wires to permit elbow connectors to be moved to their respective parking stands.
- (7) Provide insulated cable supports to relieve any strain imposed by cable weight or movement.
- (8) Transformer shall be feed thru-type.
- g. Low Voltage Equipment:
 - (1) House the low voltage bushings, and hot stick in the low voltage compartment.

The low voltage leads shall be brought out of the tank by epoxy, pressure tight bushings, and shall be standard arrangement per ANSI.
 - (2) Tin plate the low voltage neutral terminal and insulate from the transformer tank. Provide a removable ground strap sized in accordance with the NEC and connect between the neutral and ground pad.
- h. Transformers:
 - (1) Transformers shall be three-phase, liquid-immersed, isolated winding, and self cooled by natural convection. Windings shall be copper.

- (2) The KVA ratings shown on the drawings are for continuous duty without the use of cooling fans.
- (3) Temperature rises shall not exceed the NEMA Standards of 65 degrees C by resistance, and 80 degrees C hot spot at rated KVA.
- (4) Transformer insulating mineral oil shall be in accordance with ASTM.
- (5) Impedance is to be as shown on the drawings, but not less than 5.75 percent:
- (6) Sound levels shall conform to NEMA Standards.
- (7) Primary and Secondary Windings for Three-phase Transformers:
 - (a) Primary windings shall be wye connected, 13.8 KV.
 - (b) Secondary windings shall be wye connected, except where otherwise indicated on the drawings. Provide isolated neutral bushings for secondary wye connected transformers.
 - (c) Bring secondary leads out through pressure-tight epoxy bushing.
- (8) Provide four 2-1/2 percent full capacity voltage taps in the primary winding; two taps above and two below rated voltage.
- (9) Core and Coil Assemblies:
 - (a) Cores shall be rigidly braced, grain-oriented, non-aging silicon steel to minimize losses.
 - (b) Brace the core and coil assembly to withstand the stresses caused by rough handling during equipment, and stresses caused by short circuit currents.
 - (c) Primary, secondary and tap connections shall be braced or pressure type.
 - (d) Provide end fillers or tie downs for coil windings.
- (10) The transformer tank, cover, and radiator gage thickness shall not be less than that outlined in ANSI.
- (11) Accessories:
 - (a) Provide standard NEMA features, accessories, and the following:
 - 1) No-load tap changer (Provide warning sign).
 - 2) Lifting and jacking facilities.
 - 3) Globe-type valve for filtering and oil draining, including sampling device.

- 4) Pressure relieve valve.
 - 5) Liquid level gage and filling plug.
 - 6) A grounding pad in the high and low voltage compartments.
 - 7) A diagrammatic nameplate and operating instructions enclosed by a transparent cover located in the low voltage compartment.
 - 8) Dial type thermometer.
 - 9) Hot stick. Securely fasten within low voltage compartment.
- (b) The accessories shall be made accessible within the compartments without disassembling trims and covers.
3. Duct Bank and Pull-Boxes
- a. Duct bank concrete shall have 2000 psi flyash mix minimum 28 day compressive strength.
 - b. Duct Lines:
 - (1) Size: Except where otherwise shown on the Drawings, ducts and conduits shall be not less than 4-inch trade size.
 - (2) Concrete encased power ducts shall be Schedule 40 type PVC. Duct shall be suitable for use with 90 degree C rated cables. Concrete encased communication ducts shall be Inner duct type conduit where noted. Inner duct conduit shall be Opti-Com No. 43-S40PVC multi duct conduit or as accepted. It shall contain 3 - 1 1/2" PE ribbed conduits with connectors of same manufacturer.
 - (3) Manufactured bends shall be not less than 36 inches in radius for conduits 4-inch diameter or larger.
 - c. Ground wire shall be stranded bare copper No. 6 AWG minimum.

C. Execution

1. Electrical Metering

- a. Electrical service to each building as noted on the plans shall be metered for energy (kW) and demand (kWh). All electric services shall be metered on the secondary side of the pad-mounted transformer serving the building. Meter shall be mounted directly on pad-mounted transformers. Contractor shall provide additional meter to monitor the Kitchen/Food Services Panelboards as noted on the plans. Locate meter in Main Electrical Room. Meter socket shall be mounted so that the centerline of the revenue meter is easily readable. Contractor shall furnish and install all metering equipment, including meter, current transformers, meter conduit and wiring, and terminations.
- b. All electrical meters shall be furnished and installed by this Contractor. Meter shall be smart meter type, five digit, electronic programmable watt-hour meters with solid-state demand registers. Meter shall be pre-programmed for 15-minute integrated demand period and reset. Meter shall be marked with the proper multiplier for the installation. Meter shall have at least four (4) additional pulse inputs included. Meter shall be GE KV2c Smart Meter, or equal as accepted.
- c. Meter sockets, boxes and test blocks, shall be furnished and installed by this Contractor. Transformer rated meter sockets shall be 13-terminal type, three-phase, ring less type, and shall be equipped with a 10-terminal test block with shorting bars for current transformer circuits.

Acceptable Manufacturers: Milbank "UC7449-RL" (meter) and "TS0110" test switch.

- d. Current transformers shall be furnished and installed by this Contractor. All instrument transformers used for metering shall be ANSI revenue metering class. Current transformers shall be Grecian-urn style, designed for mounting directly on secondary bushings of pad-mounted transformer. Current transformers shall be sized based on anticipated load and the rating factor of the current transformers; current transformers shall not be sized solely to match service entrance disconnecting means size or rating. Current transformers shall be mounted directly on each secondary bushing of the padmounted transformer with load (H2) marking visible from front. Location, mounting provisions and connection requirements shall be coordinated by the Contractor. CT shall be GE type JAB-O or equal as accepted.

- e. All metering, conduit and conductors for the current transformers shall be furnished and installed by this Contractor. Current and potential transformer wiring shall be #10 AWG THHN/THWN copper. Meter cable shall be tie-strapped every six inches in pad-mounted transformer cabinet.

Color-coding for 120/208 volt, three phase, wye metering installations shall be as follows:

- Current transformer, phase "A" - black
- Current transformer, phase "B" - red
- Current transformer, phase "C" - blue
- Potential, phase "A" - black with white tape stripe
- Potential, phase "B" - red with white tape stripe
- Potential, phase "C" - blue with white tape stripe
- Current and potential transformer neutrals - white
- Ground - green

Color-coding for 277/480 volt, three phase, wye metering installations shall be as follows:

- Current transformer, phase "A" - brown
- Current transformer, phase "B" - orange
- Current transformer, phase "C" - yellow
- Potential, phase "A" - brown with white tape stripe
- Potential, phase "B" - orange with white tape stripe
- Potential, phase "C" - yellow with white tape stripe
- Current and potential transformer neutrals - white
- Ground - green

Meter wiring exterior to transformer shall be installed in 1" rigid galvanized steel conduit. Conduit shall be placed a minimum of 36" below finished grade. Total length of wiring shall not exceed 50 feet, unless approved otherwise.

- f. Contractor shall furnish factory meter wiring diagram with meter multiplier.
- g. Temporary electrical connections and metering, if required, are the Contractor's responsibility. Provide and install proper metering and temporary feeder from existing source, as directed by Architect and Owner.

- h. The metering installation shall be inspected by the professional and/or Owner. After satisfactory inspection, the metering installation shall be tested by an independent testing agency for accuracy and verification of the proper meter multiplier shall be included in the test report. A copy of the test report shall be furnished and approved prior to final acceptance.
- 2. Primary Electrical Service
 - a. Primary service shall consist of duct, cable and concrete pads. Duct to be 4" PVC Schedule 40 concrete-encased. Concrete encasement shall have 3" of concrete cover around all ducts and a minimum of 1" spacing between ducts. Concrete pads to be 9" thick, sized per plans with 6" underground, 3" above-ground and 1" chamfer on all exposed edges. Concrete to be 3000 psi with #6 wire-mesh top and bottom. Equipment grounding shall be #2/0 AWG bare copper girdle installed 3 feet beyond pad edges and 12" below grade. Provide four (4) 5/8" X 10' copper clad ground rods at the four corners of the girdle. Exothermic weld all connections. Leave 10' tail #2/0 AWG bare copper inside equipment.
- 3. Trenching
 - a. Cut the trenches neatly and uniformly.
 - b. For Concrete Encased Ducts:
 - (1) After excavation of the trench, stakes shall be driven in the bottom of the trench at four foot intervals to establish the grade and route of the duct bank.
 - (2) Pitch the trenches uniformly towards manholes or both ways from high points between manholes for the required duct line drainage. Avoid pitching the ducts towards buildings wherever possible.
 - (3) The walls of the trench may be used to form the side walls of the duct bank provided that the soil is self-supporting and that concrete envelope can be poured without soil inclusions. Forms are required where the soil is not self-supporting.
 - (4) After the concrete encased duct has sufficiently cured, the trench shall be backfilled to grade with earth.
- 4. Concrete Encased Duct
 - a. Duct lines shall be in accordance with the NEC, as shown on the Drawings, and as herein specified.
 - b. Duct shall be sloped to drain towards manholes and away from building and equipment entrances. Pitch shall be not less than four inches in 100 feet. Curved sections in duct lines shall consist of long sweep bends with a minimum radius of 50 feet in the horizontal and vertical directions. The use of manufactured bends is limited to building entrances and stub-ups to equipment.

- c. Upon completion of the duct bank installation, a standard flexible mandrel shall be pulled through each duct to loosen particles of earth, sand, or foreign material left in the line. The mandrel shall be not less than 12 inches long, and shall have a diameter 1/2-inch less than the inside diameter of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be the same as, or slightly larger than, the diameter of the duct.
- d. Duct lines shall consist of single or multiple duct assemblies encased in concrete, and installed with top of duct bank not less than 30 inches below established grade. Ducts shall be uniform in size and material throughout the installation, unless otherwise shown or specified.
- e. Rigid, unplasticized, polyvinyl chloride spacers shall securely support and maintain uniform spacing of the duct assembly a minimum of three inches above bottom of trench during the concrete pour. Spacer spacing shall not exceed five feet.
- f. Duct lines shall terminate in manhole walls as shown on the Drawings. All ducts shall be fitted with end bells.
- g. Couple the ducts with proper couplings. Couplings shall be staggered in rows and layers to insure maximum strength and rigidity of the duct bank.
- h. The concrete envelope encasing the ducts shall extend not less than three inches beyond the outside walls of the outer ducts and conduits.
- i. Within five feet of pullbox wall penetrations, install reinforcing steel bars within the top and bottom of each concrete envelope to provide protection against vertical shearing. Where shown on the Drawings, incorporate steel reinforcing in the duct envelopes.
- j. Ducts shall be kept clean of earth, sand, or gravel during construction, and sealed with tapered plugs upon completion of each portion of the work.

- END OF SECTION 16200 -

16250 GROUNDING AND BONDING SYSTEMS

A. Instructions

1. Bonding and grounding of electrical service equipment enclosures, raceways and ground terminals as shown on the drawings and in accordance with Article 250 of the National Electrical Code. All cubicles and conduit of the service equipment shall be bonded together.
2. Service equipment system neutral bus and equipment ground bus shall be grounded to electrodes meeting the requirements of Article 250-81 of NEC. Where available and of proper characteristics, the incoming cold water line shall be one of the electrodes.
3. Equipment grounding terminal (green) of all grounding type receptacles shall be bonded to its enclosure with a properly sized bonding conductor (green) unless the receptacle is approved for self-bonding.
4. Pull into all non-metallic raceways and other raceways where shown on drawings one green equipment grounding conductor, sized the same as the branch circuit conductors or as noted on the drawings and bond this conductor to box ground terminal, receptacle ground terminal (green), ground bus of panel, cabinet and/or enclosures.
5. Where conduits enter an enclosure, use bonding type bushing on conduits through 1-1/4" trade size with #10 AWG copper conductors bonded to all conduits thence to equipment enclosure or ground bus. Conduits in excess of 1-1/4" trade size shall have bronze ground clamps with bonding conductors sized in accordance with National Electrical Code requirements and/or as shown on the drawings.
6. Ground rods shall be 5/8" x 10'-0" copper clad sectional, solid rods. They shall be installed with top 12" below finish grade. Resistance to ground shall not exceed 25 ohms. Connections to ground rods to be by exothermic weld. Where multiple ground rods are indicated or required, they shall be driven six (6) feet apart in a straight line and connected with ground conductor sized as shown and/or per N.E.C. Article 250.
7. The equipment ground conductor shall be carried to each dry type transformer and connected to the secondary neutral connections. Size shall be same as branch circuit or as shown on the drawings.

- END OF SECTION 16250 -

16260 STAND-BY ELECTRIC POWER SYSTEM - NATURAL GAS

A. General

1. Provide and connect complete stand-by electric power system consisting of new and current equipment to automatically provide emergency power to selected loads in the event of normal power interruption. Installation shall be in strict compliance with applicable codes including but not limited to NFPA 110 and NEC Articles 700, 701, and 702. System shall be installed and connected by personnel qualified in systems of this type.
2. All material, equipment, and/or accessories necessary for proper operation of the system not specified or described herein shall be provided at no additional contract cost to accomplish the intended function of the system.
3. The contractor shall be responsible for providing adequate technical supervision by factory trained representative(s) of system manufacturer to assure proper installation and connection of the system. These personnel shall perform initial start-up, operational testing, and Owner instructional training. On-site testing shall conform to NFPA-110. Also provide cold start test and full load test of the emergency generator system including all transfer operations. Written verification and documentation of the requirements shall be submitted to Architect for approval prior to final acceptance.
4. The complete stand-by electric power system shall be warranted by the same manufacturer for one year from date of final acceptance.
5. Three (3) copies of complete operation and maintenance manuals in hardback binder(s) of the installed engine generator, automatic transfer switch and all accessories shall be provided to the Architect.

B. Instructions - Engine Generator Set

1. The stand-by generating set shall have minimum continuous stand-by rating as shown on the drawings at 0.8 power factor, 60 Hz. Generator set shall have sufficient starting KVA to start all connected loads with maximum 20% voltage dip and shall recover to +/- 0.5% of rated voltage within four seconds.
2. Vibration isolators shall be provided between the engine generator and heavy duty steel base or between the base and the slab and/or floor.
3. The generator set engine shall be natural gas fueled with electric fuel shut-off. The engine shall have an isochronous governed speed of 1800 rpm. The engine shall be liquid cooled with mounted radiator, fan and water pump. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have air cleaner and fuel and oil filters with replaceable elements. Starting shall be by positive engagement solenoid shift-starting motors. Engine generator shall have minimum 35 ampere automatic battery charging alternator with solid-state voltage regulation.

4. The generator set alternator shall be salient-pole, reconnectable self-ventilated of drip-proof construction with amortisseur rotor windings skewed for smooth voltage waveform. Unit shall be connected to provide proper system voltage. The generator shall be directly connected to the flywheel housing with a semi-flexible coupling between flywheel and rotor with maintenance free bearing. Insulation material shall meet NEMA standards for Class H and be vacuum impregnated with epoxy varnish to be fungus resistant. Temperature rise of the rotor and stator shall be limited to 150 degrees Celcius. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator with adjustable volts-per-hertz operation capable of maintaining voltage within +/- 2% at any constant load from 0 to 100% of rating. The regulator must be sealed from the environment and isolated from the load to prevent tracking when connected to SCR loads. Frequency regulation shall be isochronous and +/- 0.25% steady state.
5. The generator shall be capable of sustaining at least 300% of rated current for at least 10 seconds under a three phase symmetrical short by inherent design or by the addition of a current boost system.
6. The generating set shall have complete set-mounted, vibration isolated microprocessor-based controller rated for operation in the environment installed. Controller shall include:
 - a. Complete start/stop control which shall operate on closure of remote contact(s).
 - b. Speed sensing and a second independent starter motor disengagement system shall protect against the starter engaging with a moving flywheel. Starting system shall be designed for restarting in the event of a false engine start.
 - c. Overcrank protection designed to open the cranking circuit after 75 seconds if the engine fails to start.
 - d. Circuitry to shut down the engine when signal(s) for high coolant temperature, low oil pressure or overspeed is received.
 - e. Engine cool down timer factory set to permit unloaded running of the generator set after transfer of the load to normal.
 - f. Three-position (Auto - Off - Test) selector switch. In the "test" position, engine shall start and run regardless of the position of the remote starting contacts. In the "automatic" position, engine shall start upon closure of remote starting contacts. In the "off" position, the engine shall not start under any condition. The "off" position shall also provide immediate emergency shutdown of the generator set.
 - g. Indicating lights to signal the following: Not-in-auto, overcrank, emergency stop, high engine temperature/low coolant level, overspeed, low oil pressure, battery charger malfunction, low battery voltage, low fuel, system ready, pre-alarm high engine temp., pre-alarm low oil pressure, low coolant temperature, auxiliary fault, auxiliary fault pre-alarm. A test button shall be provided for testing all indicating lights.
 - h. Alarm horn with silencer

- i. Terminal connection isolated dry contacts and a remote alarm annunciator with audible and visual signals meeting NFPA-110 shall be provided and installed where indicated on the drawings, or if location not shown, at a location complying with NFPA-110 as approved by Architect.
7. A generator set instrument panel shall be set-mounted, vibration isolated, connected and tested by the generator set manufacturer. The instrument panel shall contain dual range volt meter, dual range ammeter, voltmeter-ammeter phase selector switch, lights to indicate high or low meter scale, frequency meter, panel illuminating lights, battery charger meter, coolant temperature gauge, oil pressure gauge, running time meter, voltage adjustment rheostat.
8. The following accessories shall be provided and connected:
 - a. Heavy-duty battery(ies), corrosion proof battery rack, battery cables. Battery(ies) shall be capable of delivering the minimum cold-cranking amps required at zero degrees Fahrenheit per SAE standard J-537.
 - b. Weather-proof housing complete with lockable/removable doors. Exhaust silencer to be vibra-mounted to roof of housing.
 - c. Flexible fuel lines, fuel solenoid and fuel regulator.
 - d. Engine exhaust silencer and tail pipe. Coated to be temperature and rust resistant and rated for critical applications.
 - e. Block heater of proper wattage and voltage, thermostatically controlled to maintain engine coolant at 90 degrees Fahrenheit.
 - f. Ten (10) Ampere automatic float and equalize battery charger with alarms when remote annunciator is supplied.
 - g. A resettable, U.L. listed thermal magnetic line current sensing circuit breaker with inverse time versus current response shall be provided and shall not automatically reset.
9. The engine generator shall be as manufactured by Kohler model number 50REZGB or equal in Onan, Detroit Diesel, Taylor or Caterpillar.
10. Engine generator shall be mounted on concrete pad of dimensions as recommended by the manufacturer and shall have a minimum of 18" of additional width of each side of the recommended dimensions for service walkway. Concrete pad to be 9" thick with 6" underground, 3" above finished grade and 1" chamfer on all exposed edges. Concrete to be 3000 PSI with #6 wire mesh top and bottom.

C. Instructions - Automatic Transfer Switch

1. The automatic transfer switch (ATS) shall consist of a power transfer module and a microprocessor-based control module, interconnected and coordinated with engine generator set to provide complete automatic transfer operations between the normal and stand-by power sources.
2. ATS shall be rated for the connected generator voltage and phase and with a continuous-duty ampere rating as indicated on the drawings 3 phase, 4 wire with solid neutral connection with proper lugs. It shall be enclosed in a NEMA 1 wall mounted cabinet. The transfer switch shall be mechanically held on both sides and electrically operated with interlock(s) to ensure only one of the two positions is closed at any time. The ATS shall have a fault current withstand rating as shown on the drawings or if rating not shown, the same rating as the K.A.I.C. rating of the normal service panel. Normally open and normally closed auxiliary contacts (rated at 10 amperes at 480V) shall be provided and connected as required for operation and interface with external systems as shown on the drawings, herein specified, or as required. A manual handle or operator shall be provided.
3. Each normal power source phase and at least one phase of the emergency source shall be monitored by an under-voltage relay with at least one of these relays being a close differential type field adjustable for 75% to 100% pickup (factory set for 95%) and 70% to 90% dropout (factory set at 85%). Anti-single phasing protection shall detect regenerative voltage as a failed source condition. Adjustments shall be made by keypad/keyboard without having to open ATS enclosure door or use of special tools. A voltage-frequency relay shall be provided to lockout transfer of the load to the generator until the generator output has reached 90% of rated voltage and frequency. Transfer switch shall accomplish "in-phase" retransfer to the line when the preferred power source returns.
4. Control module shall include programming keypad/keyboard, alpha-numeric display, key-lockable program selector switch, LED status indication and integral programmable clock and calendar. Programmed settings shall be stored in non-volatile EEPROM memory. All programmed features shall be field adjustable without opening ATS enclosure door.
5. Control module shall contain all necessary circuitry, switches, contacts, relays, etc. to perform the following: (a.) automatically and manually initiate starting of the engine generator in either loaded or unloaded mode of operation, (b.) automatically or manually initiate transfer of load, (c.) programmable plant exerciser (d.) programmable engine cool-down period.
6. Control module shall have the following adjustable time delays as a minimum: (a.) engine start delay to delay initiation of transfer for momentary source outages (range 0 to 6 sec.) (b.) transfer to emergency delay (0-5 min.) (c.) transfer back to preferred source delay (0-30 min.) (d.) engine cool down delay (0-30 min.)

7. Control module shall include pilot lights that show switch position for normal and emergency and normal and emergency power acceptable. Keypad functions shall include digital voltmeter, digital frequency meter and digital running time meter.
8. The automatic transfer switch shall be as manufactured by Kohler or equal in Onan, Russ Electric or Asco.

- END OF SECTION 16260 -

16300 ELECTRICAL DISTRIBUTION SYSTEM

A. Lighting and Power Panelboards

1. Shall be dead front construction with solderless pressure terminals.
2. Main and neutral busses of capacity shown or indicated herein to be completely tin and/or silver plated copper based on 1000 amps per square inch current density.
3. Securely mounted with through bolts anchors or other approved means. Contractor shall provide proper mounting surface if wall of insufficient strength. All wood or other flammable mounting surfaces shall be painted with two coats of flame resistant paint.
4. Complete typewritten directory with transparent plastic cover inside of door. All panels shall be identified as they are designated on the drawings by 3/4" plastic nameplate, white with minimum 1/2" high black engraved letters, on front face if panel is surface mounted or inside of door if panel is flush mounted.
5. Trim and door with lock and catch with two (2) keys. Keys common to all building panelboards.
6. Mount panelboards with top breaker handle not more than 6'-6" above floor. Installation of flush panels shall not compromise fire rating of walls.
7. Connect the phase wires of homeruns to breakers connected to separate phase busses of the panelboard and maintain approximately equal loads on each bus. Panelboard circuits shall be numbered in sequence vertically down the left side then vertically down the right side and all circuits shall appear in the panel exactly as they are shown on the drawings. Numbering to be consecutive for double or triple section panels. Neutral connections shall be identified by adhesive number tags to identify with their branch circuit phase conductors.
8. Typed copy of circuit directory to be installed for each panelboard and shall be submitted with shop drawing submittal for approval.
9. Lighting and/or power panelboards complete with feeders, branch breakers and branch circuits as scheduled on the drawings.
10. Circuit breakers shall have bolted connections and shall have minimum interrupting rating and voltage rating as shown on drawings. All single pole 15 and 20 ampere circuit breakers shall be UL listed SWD for switching duty. All circuit breakers serving HVAC equipment shall be UL rated HACR. All 15 and 20 amp circuit breakers serving high magnetic (HM) or high intensity discharge (HID) loads shall be HM or HID rated.

11. Manufacturers shall be General Electric type AQ or equal in Square D Company, Siemens or Cutler Hammer.
- B. Distribution Panelboard
 1. Shall be dead front construction with solderless pressure terminals.
 2. Main and neutral busses of capacity shown or indicated herein to be completely tin and/or silver plated copper based on 1000 amps per square inch current density.
 3. Securely mounted with through bolts anchors or other approved means. Contractor shall provide proper mounting surface if wall of insufficient strength. All wood or other flammable mounting surfaces shall be painted with two coats of flame resistant paint.
 4. Cabinets code gauge steel with trim and door with lock and catch and two (2) keys common to all building panelboards.
 5. Each breaker shall be labeled as to load served by 1/2" bakelite label, white with minimum 1/4" high, black engraved letters. Panel designation as indicated on drawings shall be identified by 3/4" bakelite label, white with minimum 1/2" high, black engraved letters on face of panel.
 6. Bushings on all raceways entering panel. Bushings of substantial insulating type to be OZ type "BLG" or equal approved by Architect.
 7. Mount with top over-current unit not over 6'-6" from floor.
 8. As shown on the drawings and as specified herein the following service entrance equipment specifically approved for that purpose.
 - a. Circuit breaker type panelboard quick-make/quick-break, of proper voltage for system, with frame sizes and characteristics as shown on the drawings.
 - b. Where shown on the drawings, distribution panel shall have transient voltage surge suppression unit as specified in section 16310 mounted and connected per manufacturer's recommendations.
 9. Manufacturer shall be General Electric Company type SCP or equal in Square D Company, Siemens or Cutler Hammer.
 10. One engraved plastic, white letters on black field, nameplate on switchboard, approximately 5" x 10" in size, lettering as follows:

SCHULTZ & WYNNE

CONSULTING ELECTRICAL ENGINEERS, P.A.

_____, ELECTRICAL CONTRACTOR

YEAR

BUILDING NAME

- END OF SECTION 16300 -

16310 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) DEVICES

A. General

1. Where shown on the drawings or herein specified, a parallel-connected transient voltage surge suppresser/high frequency filter system shall be provided and connected per manufacturer's recommendations. Unit(s) shall be rated for the voltage of the system where installed.
2. Unit(s) shall be U.L. 1449 third edition listed as a transient voltage and surge suppresser and U.L. listed as an electromagnetic interference filter. Unit shall have maximum continuous operating voltage (MCOV) of a minimum of 125% at 120 volts and 115% at 208-600 volts.
3. The unit(s) shall protect in all modes on all phases (line to line, line to neutral, line to ground, and neutral to ground) per IEEE Standard 1100-1992. Units shall be connected to protected panel using minimum #2 AWG conductors no greater than 6 feet in length.
4. The high frequency filtering system shall utilize a "pi" filter design.
5. Units as supplied shall have been tested in all modes for all specified parameters by an industry recognized independent test laboratory. Complete test reports and results as prepared by the testing laboratory shall be provided to the Architect with equipment submittals per NEMA Standard LS-1 latest edition.
6. Upon completion of installation, a factory-certified technician shall provide to the Architect a test report certifying the following:
 - a. The unit(s) is/are installed and connected properly per the manufacturer's recommendations.
 - b. The unit(s) is/are operating properly and within specified parameters.

B. SPD device parameters:

1. High Exposure, Service Entrance Distribution Panel/Switchboard
 - a. Tested single pulse surge current capacity shall be 150 KA/mode line-to-line, 150 KA/mode line-to-neutral, 150 KA/mode line-to-ground, and 150 KA/mode neutral-to-ground.
 - b. Minimum tested repetitive surge current capacity of 12,000 impulses in all modes utilizing an IEEE Category C3 short circuit current (1.2 x 50 microsecond, 20KV open circuit voltage, 8 x 20 microsecond, 10KA short circuit current) without suffering component degradation or deviation of clamping voltage by more than 10% of original ratings.
 - c. Clamping voltages for 208Y/120 volt, IEEE B3/C1 combination wave shall be a maximum of 400V - LN, 400V - LG, 400V - NG, 800V - LL. Clamping voltages for 480Y/277 volt, IEEE B3/C1 combination wave shall be a maximum of 825V - LN, 825V - LG, 825V - NG, 1625V - LL.

- d. High frequency noise filtering/attenuation shall be a minimum of 44dB at 100KHz, 33dB at 1MHz, 36dB at 10MHz, 53dB at 100MHz. Provide graph of attenuation versus frequency for 100KHz to 100MHz.
- e. Unit(s) shall be provided with integral disconnect switch and shall be connected to bussing of designated switchboard/panelboard per manufacturers recommendations.
- f. Unit(s) shall be as manufactured by Current Technologies, Inc. SEL150 Series or approved equal.

- END OF SECTION 16310 -

16340 WIRING DEVICES

A. Wall Switches (line voltage)

1. Flush A.C. tumbler-type ganged together under one non-sectionalized plate in gangable boxes where two or more switches occur at one point. Provide metal barrier within box between all adjacent switches served by circuit conductors of different phases or conductors of a different system.
2. Install switches to cut ungrounded conductors.
3. Wall switches shall be mounted 48" above finished floor to center of operating handle or as noted on the drawings. Mounting heights may be adjusted slightly to permit cutting of masonry block to the top or bottom of the block course nearest the specified height. All mounting heights shall be consistently cut above or below block coursing such that switches will be the same height above the finished floor. First switch of single or ganged switch bank shall be mounted within 12" of door frame and/or edge of door.
4. Lighting control switches shown at door ways shall be mounted adjacent to door ways on opposite side of door from hinges unless prohibited by wall space. Where switches must be mounted on same side of door as hinges, mount switches so as not to be located behind opened door.
5. Switches to be as manufactured by Hubbell, as stated, or approved equal in Pass and Seymour (P&S), Arrow Hart or Leviton. Contractor shall verify device color with Architect prior to ordering devices.

Single pole, 20A, 120/277V: Hubbell Cat. No. HBL1221, P&S Cat. No. 20AC1, Arrow Hart Cat. No. 1991, Leviton Cat. No. 1221-2.

Three way, 20A, 120/277V: Hubbell Cat. No. HBL1223, P&S Cat. No. 20AC3, Arrow Hart Cat. No. 1993, Leviton Cat. No. 1223-2.

Four way, 20A, 120/277V: Hubbell Cat. No. HBL1224, P&S Cat. No. 20AC4, Arrow Hart Cat. No. 1994, Leviton Cat. No. 1224-2.

B. Miscellaneous Switches

1. All devices shall be furnished and installed according to manufacturer's recommendations including NEMA housing suitable for the environment where located.
2. All motor starters shall have thermal overload elements sized to actual motor nameplate amperes or as provided in Article 430, Part C of the National Electrical Code.

3. All safety switches shall be heavy duty as defined by NEMA and shall be of voltage as required by the particular circuit on which they are installed. Each switch shall have indented plastic tape label identifying load served with voltage, horsepower, panel and circuit number. All fused switches shall be fused with Bussman Fusetron dual element type fuse as appropriate to the circuit voltage with size fuse indicated on the drawings.
4. Safety switches and lighting contactors shall be mounted 54" to center of operating handle above the finished floor or finished grade where mounted unless shown or noted otherwise on the drawings. Where safety switch is located behind equipment screen walls, mount switch such that top of the enclosure is 6" below top of screen wall and bottom of enclosure is a minimum of 18" above the finished grade or slab.
5. The following miscellaneous switches/contactors with manufacturer as stated or equal in Square D, Allen Bradley, General Electric or equal approved by Architect:

<u>Item</u>	<u>Mfg.</u>	<u>Cat. No.</u>
Manual motor switch, single pole	Square D	Class 2510, type FO-1
Safety switch, heavy duty with ground lug	Square D	H200-H300 Series
Contactors, multi-pole electrically held, size as indicated with hand-off auto selector switch	Square D Co.	Class 8903, Type L or S
Time switch, 2 channel, momentary contacts, astro dial, daylight savings/ leap year correction, programming keypad, with light sensor	Paragon	EL72 Series with LS-R
Dimmer Switch, LED	Lutron	"Nova" Series

C. Receptacles

1. Convenience outlets and receptacles shall be mounted center line up 16" above finished floor unless shown or noted on the drawings otherwise. Convenience outlets and receptacles located at counters shall be mounted center line up 4" above counter top or backsplash unless shown or noted on the drawings otherwise. Mounting heights may be adjusted slightly to permit cutting of masonry block to the top or bottom of the block course maintaining the minimum specified height. All mounting heights shall be consistently cut above or below block coursing such that receptacles/outlets will be mounted the same height above the finished floor. Adjacent devices to be mounted at same height unless otherwise directed.

2. Carefully review Architectural, Furniture and Interior Design drawings for furniture, casework or millwork. Do not rough-in receptacles behind equipment except where specifically noted. Where receptacle is shown behind equipment, verify proper mounting height with the Architect prior to rough-in.
3. Convenience outlets and receptacles as manufactured by Hubbell, as stated or equal in Pass and Seymour (P&S), Arrow Hart or Leviton. Contractor shall verify device(s) color with Architect prior to ordering.

Duplex grounding receptacle (construction grade), 20A, 125V: Hubbell Cat. No. CR5362, Pass & Seymour Cat. No. 5362, Arrow Hart Cat. No. 5352, Leviton Cat. No. 5362.

Duplex grounding receptacle, ground fault interrupter type (construction grade), 20A, 125V: Hubbell Cat. No. GF5352, P&S Cat. No. 2091, Arrow Hart Cat. No. GF5342, Leviton Cat. No. 6899.

Duplex grounding receptacle, weatherproof, ground fault interrupter type (construction grade), 20A, 125V, mount in type FD box with plate: Hubbell Cat. No. GF5352, P&S Cat. No. 2091, Arrow Hart Cat. No. GF5342, Leviton Cat. No. 6899. Plates shall be equal to Hubbell Cat. No. 5206WO or Cat. No. WP8MHP for permanent or "in-use" outdoor cord and plug connections.

Duplex grounding receptacle on standby generator(s), red (construction grade), 20A, 125V: Hubbell Cat. No. CR5352R, P&S Cat. No. 5362RED, Arrow Hart Cat. No. 5352R, Leviton Cat. No. 5362R.

4. Special purpose receptacles shall be as indicated on the drawings. Each shall be commercial grade, of proper NEMA configuration for equipment served and equipped with proper plug completely installed.

D. Occupancy Sensors

1. Occupancy sensors shall be the following as manufactured by Leviton or approved equal in WattStopperl or Unenco. Contractor shall verify device color with Professional prior to ordering devices.

Wall-box occupancy sensor, passive infrared, 180 degree X 2100 s.f., with manual on/off override switch: Leviton Cat. No. ODS15-ID, Unenco Cat. No. WSR-1200.

Occupancy Sensor, ceiling mount, multi-technology type (infrared/ultrasonic), 360 degree X 2000 s.f., with power pack: Leviton Cat. No. ODC20-M0W-ODP, WattStopper Cat. No. CI-205, Unenco Cat. No. CUI-500-2000.

Occupancy Sensor, ceiling mount, multi-technology type (infrared/ultrasonic), 180 degree X 500 s.f., with power pack: Leviton Cat. No. ODC10-M0W-ODP, WattStopper Cat. No. CI-205, Unenco Cat. No. CUI-800-1500.

Occupancy Sensor, ceiling mount, ultrasonic type, 360 degree X 2000 s.f., with power pack: Leviton Cat. No. ODC20-U0W-ODP, WattStopper Cat. No. W2000H, Unenco Cat. No. C500-2000.

Occupancy Sensor, ceiling mount, ultrasonic type, 180 degree X 1000 s.f., with power pack: Leviton Cat. No. ODC10-U0W-ODP, WattStopper Cat. No. W1000H, Unenco Cat. No. C500-1000.

Occupancy Sensor, ceiling mount, passive infrared, 360 degree, 360 degree X 450 s.f., with power pack: Leviton Cat. No. OdC04-I0W-ODP, WattStopper Cat. No. CI-200-1, Unenco Cat. No. PIR-6.

2. Occupancy sensors shall be rated for the load connected (incandescent, fluorescent, etc.) and shall be wall-box or ceiling mounted device(s) as shown or noted on the drawings.
3. Supplied device manufacturer shall provide a layout plan for each space shown to have the lighting controlled by an occupancy sensor. Device layout shall provide maximum coverage of the installed space. The layout plan shall dictate the type of device, the mounting height and location and the aiming parameters. Each device shall be located and aimed per the manufacturer's recommendations. Division 16 Contractor is responsible for all adjustments and final settings of devices for proper operation.
4. Wall-box sensors shall be mounted 48" above finished floor to center of the device, as noted on the drawings or at same height as wall switches. Mounting heights may be adjusted slightly to permit cutting of masonry block to the top or bottom of the block course nearest the specified height. All mounting heights shall be consistently cut above or below block coursing such that switches will be the same height above the finished floor.
5. Wall-box sensors shown at door ways shall be mounted adjacent to door ways on opposite side of door from hinges unless prohibited by wall space. Where devices must be mounted on same side of door as hinges, mount so as not to be located behind the opened door. Device shall be mounted within 12" of door frame and/or edge of door.
6. Ceiling mounted units shall receive control power from a separately mounted auxiliary power and control unit (power pack). The occupancy sensor shall control the operation of the power switching contacts in the power pack.
7. Shall turn lighting luminaires "on" when room/space is occupied and "off" when unoccupied unless otherwise indicated on the drawings. Sensor location, aiming and adjustment shall insure that lighting turns "on" immediately as occupants enter room/space from all entrances. Shall have field adjustable "off" delay of 1 to 15 minutes minimum.

- END OF SECTION 16340 -

16400 LIGHTING FIXTURES

A. Lighting Fixture General Requirements

1. Provide all lighting fixtures as shown on the drawings by symbols and as defined in the lighting fixture schedule(s). Fixtures shall be provided with all necessary mounting accessories. The installation of all fixtures shall be complete, safe and in full accordance with manufacturer's recommendations and these specifications. This contractor shall provide additional 1-1/2" x 1-1/2" x 12 ga. channel bridging where necessary to mount lighting fixtures governed by the conditions encountered.
2. Procure fixtures completely factory wired for proper operation in the application shown on the drawings. All fixtures shall be furnished with proper fittings and accessories for installation in the area encountered. This Contractor shall review the Architectural plans and specifications and provide fixtures compatible with the ceiling specified in each area.
3. Substituted fixtures shall meet the performance and functional characteristics and the general appearance and dimensions (+/- 10%) of the specified fixtures. Approval of submitted substitute fixture(s) shall not eliminate the Contractor's responsibility to provide fixtures similar in characteristics to the specified fixture(s).
4. Recessed fixtures in accordance with Article 410 of the NEC. All recessed fixtures in accessible ceilings shall be connected with 1/2" flexible conduit from accessible junction box with sufficient length to allow fixture to be relocated to any adjacent ceiling panel without disconnecting. 3/8" flexible conduit may be used if furnished with the fixture by the manufacturer. All recessed fixtures in non-accessible ceilings, unless otherwise indicated, shall be pre-wired from the factory with junction box for terminating branch circuit conduit.
5. Fixture mounting shall be rigid and independent of the ceiling tile(s) and shall be supported from the major structural elements of the ceiling system. Recessed fluorescent fixtures requiring a ceiling opening in excess of nine (9) square feet shall be supported independent of the ceiling system. Fixtures mounted to concrete shall be anchored with concrete inserts or other means of similar strength as approved by the Architect.
6. Surface fixtures mounted on combustible ceilings or low density acoustical tile ceilings shall be UL approved for such mounting. Where surface fixtures are served by exposed raceway, fixture shall have surface conduit collar furnished by manufacturer. Surface fixtures mounted on LAT ceiling shall be supported from the major tees and connected via flexible conduit similar to recessed fixtures.
7. Recessed fixtures shall be furnished to properly coordinate with the fire rating of the ceiling. Where fire rating requires covering over fixture housing, ballast of proper temperature rating as recommended by manufacturer shall be furnished.

8. Lighting fixture lenses specified by catalog number and/or by descriptive reference shall be virgin acrylic plastic and shall equal or exceed IES-SPI-NEMA test for yellowing factor of not to exceed 3 after 2000 hours exposure in a Fade-o-meter for the standard test conditions. The flat portions of all lenses shall be not less than .125 inches thick and shall weigh not less than 8 ounces per square foot.
9. All three and four lamp parabolic type fluorescent troffers shall be provided with two wireway covers for proper light distribution under half-light switching regardless of whether or not the wireway is required for the ballasts provided in the fixture.
10. Luminaires mounted with bottom edge above finished floor as indicated on the drawings unless specifically noted otherwise. The catalog numbers of recessed luminaires, where applicable, are for use in an exposed grid suspension type ceiling system. The Contractor is responsible for providing luminaires with the proper hardware and/or accessories for installation in the ceiling type encountered.
11. Each exterior pole mounted lighting fixture shall be provided with a concrete pole base as detailed on the drawings or if detail not shown as specified herein. Pole bases shall be of 3000 p.s.i. concrete with #6 bars and #4 ties six inches on center in both directions. All exposed concrete shall have a trowel finish and all exposed edges shall have a 1"X45 degree chamfer. Pole bases supporting square poles shall be square and pole bases supporting round poles shall be round. The pole base diameter shall be sized to provide a minimum of three inches of concrete coverage beyond the bolt circle and a shelf two inches wider on all sides than the pole anchor base cover. Provide grout between pole anchor base and top of concrete pole base and slope to drain. Pole base shall extend 8 feet below the finished grade and 3 feet above the finish grade where poles are located in or adjacent to vehicular traffic areas or 6 inches above the finished grade in all other areas. Bond conduit and/or ground conductor to pole.
12. All LED luminaires and/or components shall be tested in accordance with IESNA-LM-79. Provide LM-79 test results for the total luminous flux, electrical power, efficacy and chromaticity on luminaire cut sheets. All LED light sources' lumen maintenance shall be tested in accordance with IESNA-LM-80. Provide LM-80 test results on luminaire cut sheets. All LED luminaires shall carry a minimum 5 year warranty.

B. Lighting Fixture Lamps

1. Provide lamps of proper size and type in each lighting fixture. Lamps shall be as manufactured by Phillips, General Electric, Sylvania, Venture or equal approved by Architect.
 - a. Incandescent/Quartz/Halogen Lamps, 130V
MR lamp, 20W thru 73, clear, 12 volt.

C. Fluorescent Lighting Fixture Requirements

1. Fluorescent Lighting Fixture Ballasts. Fluorescent lighting fixtures shall be provided with integral electronic ballasts of the full light output type unless specifically noted otherwise on the drawings. Provide number of ballasts as indicated or as required for lighting fixture switching configurations per the drawings. Ballasts shall be as manufactured by Howard Industries or equal in Magnetek, Advance or Motorola and shall meet the following specifications:

Listing:	U.L. listed, Class P
Lamp Current Crest Factor:	< 1.7
EMI & RFI Limits:	EMI & RFI emissions shall be minimal and shall comply with the limits of FCC Part 18C for non-consumer equipment.
Transient Protection:	Withstand voltage transients in accordance with ANSI C62.41, Category A2.
Operating Frequency:	> 20kHz without visible flicker
Starting Temperature:	0 degrees F
Circuit Configuration:	Programmed Rapid Start with parallel circuit configuration
Sound Rating:	Class A or better
Power Factor:	> 95%
K-Factor:	< 2.0
Input Voltage Range:	+/- 10% of specified voltage
Total Harmonic Distortion (THD):	< 10%
Ballast Factor (BF) (avg.):	0.88

All ballast serving lighting fixtures utilizing compact fluorescent type and T5 type lamps shall have auto-resetting, end-of-life circuitry to shut off lamp to prevent lamp damage.

D. HID Lighting Fixture Requirements

1. HID Lighting Fixture Ballast. All HID ballast serving lamps 100W or greater shall have constant wattage autotransformer (CWA) or SCWA circuit types. All HID ballasts shall have a minimum power factor of 90% and of proper voltage for branch circuit encountered or be multi-tap type. All HID ballast shall be U.L. listed and shall meet all requirements of the N.E.C.
2. All fixtures containing HID lamps shall be equipped with protection to prohibit excessive UV radiation should outer globe of lamp be broken. Protection shall be in the form of extinguishing mechanisms or protective shield on base of fixture.

E. Programmable Lighting Control System

1. Where shown or noted on the drawings, certain lighting circuits/fixtures shall be controlled by a programmable lighting controller with low voltage switch inputs for network operation. All programming shall be performed from a computer provided under this section of the specifications. The programmable lighting controller shall have the following features, components and accessories as a minimum:
 - a. Relay cabinet section enclosure(s): Minimum 48 relay capacity unless shown otherwise on the drawings with NEMA 1 enclosure with removable hinged, lockable door and integral power supply (120V). Enclosure door shall have access to panel controller.
 - b. Relays: Rated 20 amps at 120/277 volts, electrically or mechanically held, SPST, normally open operation. Relays shall avoid creating a demand peak when facility power is restored after a power outage condition. Relays shall carry a minimum 10 year warranty.
 - c. Status LED's: Provide LED lamp to indicate proper operation and/or status of the following as a minimum: Power, Network Communications, System OK, ON/OFF Status of each Relay.
 - d. Contact inputs: Provide connection terminals (minimum one per relay) for low voltage switching banks or any dry contact closure input (momentary and/or maintained). An input shall be linkable via programming to any number of relays for override control.
 - e. Analog inputs: Each control panel shall be capable of monitoring and controlling outputs from analog sensors. Photo-sensing control shall allow the user to specify the actual footcandle level where the desired switching shall occur. Initial setting shall be 5 footcandles. An internal deadband timer shall prevent lights under photo-cell control from toggling inadvertently as the sensor passes through the control threshold. Exterior lighting shall be controlled by combination photo-cell/time-of-day programming.
 - f. Battery back-up: Provide a memory back-up that is system integrated and maintenance free. Both the system clock and RAM data shall be protected against power interruptions for a one week duration minimum.
 - g. Service Overrides: Provide three-position service override switch for each relay and a three-position master override switch for the entire panel. Override switches shall have ON-AUTO-OFF positions. System shall remember the last command to each relay and shall return to the most recent command state upon return of override switch(es) to the AUTO position.

- h. Schedules: Unlimited day schedules, separate schedules for each day of the week plus a holiday schedule with single and repeat dates.
- i. Modem/Printer: Control panel shall provide printer port for local printing direct from the panel and shall provide printout capability of programmed information. The control system shall be capable of modem communications via a serial communication port.
- j. Network: Control system shall be capable of panel-to-panel and computer-to-panel communications over a high-speed, hard-wired, RS-485 network protocol twisted pair data network. Opto-isolation circuit protection shall be provided on the network. The network shall support a minimum of 250 control panels. Maximum distance between first and last panel/computer shall be 2000 feet minimum. Panels shall utilize BACNET ANSI standard protocol and be capable of inter-operation with other building systems.
- k. Configuration software package: Provide PC-based software capable of operating on any Windows 95/98 operating system for initial programming, program modification and/or configuration of lighting control panel(s) connected to the network in either an on- or off-line mode. Personal computer with minimum requirements as listed herein shall be provided. Software package shall permit the PC to be utilized for other functions (i.e., word processing, database, etc.) other than for lighting control programming. Software package shall store all programmed data and archive for future use. Control panel(s) shall have resident software for full operation of lighting system without connection to the personal computer. Supervising software equal to Lithonia Catalog No. RC SYSW CONFIG or approved equal.
- l. Low voltage switches: Lithonia LVMS//WPM Series with plates or approved equal.
- m. Network remote switch control stations: Lithonia SYRS Series or approved equal.
- 2. The low voltage control system shall be Lithonia Control Systems Synergy Series, Leviton Intelligent Lighting Controls or approved equal.
- 3. Initial programming of system shall be provided by the Contractor per the Architect's direction. Complete operation, maintenance and programming manual(s) shall be provided with the unit.

E. Dimming and Control System

- 1. Shall be installed in conduit. Control wiring and conduits though not shown on drawings shall be furnished and installed by the contractor to accomplish the intent of the system as shown on the drawings by symbols and this specification.
- 2. Furnish all equipment, accessories, material and labor required to install and connect in accordance with these specifications and applicable drawings for fully operational Dimming and Control System to the complete satisfaction of the Architect. All material and/or equipment necessary for the proper operation of the system not specified or described herein shall be deemed part of the specifications.

3. System shall consist of dimmer panel with solid state dimmers, user interface stations, A/V and contact closure interfaces and control devices as required by the drawings and/or listed herein and complete interconnecting cabling system for a complete and operable Dimming and Control System. Each component of the system shall be listed under the appropriate category by UL and the complete system installation shall conform to the individual component UL listings.
4. System manufacturer shall provide check out and start-up of entire system after installation by the Contractor. System manufacturer's technician shall provide up to eight hours of operation and maintenance training for the Owner's selected personnel on the installed system at the Owner's convenience. The training session shall be video taped (using a VHS format) by the Contractor and the completed tape submitted to the Architect with project close-out documents. A pre-recorded factory produced training tape(s) on each component of the supplied system(s) may be substituted.
5. Initial programming of system(s) shall be provided by the Contractor per the Architect's direction. Complete operation, maintenance and programming manual(s) shall be provided with the unit.
6. System components shall be the following as manufactured by Lutron, manufacturer listed, or approved equal. Quantities shall be as shown on the drawings, listed herein and/or as required for proper system operation per the drawings and this specification. All cabling shall be as recommended by the system manufacturer or exact equal.

- END OF SECTION 16400 -

16500 TELEPHONE/DATA SYSTEM - RACEWAY ONLY

A. Instructions

1. Applicable requirements listed under paragraphs Title 16110 "RACEWAYS AND FITTINGS", 16160 "BOXES AND FITTINGS" and "Plates" shall apply.
2. Verify telephone requirements with Telephone Company before installation. Assume responsibility for failure to do so. Report any recommendation for changes to the Architect.
3. Conduit system without conductors, including boxes, backboards and plates as shown on the drawings.
4. Mount boxes with center at same height as nearby receptacles, as noted on the drawings, or at 16" to centerline. Boxes shall be 4" square with appropriate depth single gang raised cover.
5. Telephone/Data conduits and rough-in provisions not less than six (6) inches from any source of alternating current, unless separated by grounded metallic partition.
6. Telephone/Data backboards sized as shown on the drawings of 3/4" plywood long dimension vertical. Backboards shall be painted with two (2) coats of good quality fire retardant black enamel paint. Each backboard shall have double duplex receptacle properly located and connected to dedicated circuit.
7. Each telephone/data backboard shall have a #6 AWG minimum or size as noted on the drawings stranded ground wire installed. Ground wire shall originate from the service equipment ground bus and shall be installed in 3/4" conduit. Bond conduit to grounding conductor at all wire exit points and install bushing. Bonding conductor may be installed from backboard to backboard or radially from service equipment. Splices if required shall be made with compression fittings.

- END OF SECTION 16500 -

16600 SPECIAL SYSTEMS

A. General

1. The following systems indicated below and specified in detail hereinafter require specialized skill and experience in their installation and shall adhere to the requirements of this section.

Section Number
16610

Title
Fire Alarm and Detection System

2. Each system shall be installed in strict accord with all applicable codes including ANSI, UL and NFPA standards which apply.
3. Component storage on site shall include special precautions against temperature and humidity variations which exceed manufacturer's recommendations. Any component which appears to be damaged due to storage conditions shall be repaired or replaced as directed by the Architect.
4. Shop drawings for systems shall include, in addition to the requirements of Section 16100, "BASIC MATERIALS AND METHODS", a complete system one-line diagram and the name and address of the supply company. Qualifications of the supply company are subject to the approval of the Architect and may be cause for system rejection even though specified materials are submitted. The one-line diagram of the system shall be approved by the Architect prior to shipping materials to the job.
5. Three (3) copies of complete operational and repair manuals for each system shall be furnished to the Architect at job acceptance. These manuals shall be post-bound and indexed and shall include catalog information, operating procedures in detail, wiring diagrams of all components, complete system one-line diagrams and address and phone number of the service department of the supply company.

B. Instructions

1. System components shall be purchased from a factory authorized company who maintains a complete inventory of spare parts and who has an active and experienced service organization capable of providing repair service within 24 hours.
2. System installation shall involve factory-trained, well experienced technicians of the company supplying the components. These technicians shall perform the following functions as a minimum.
 - a. Review component location and recommend any revisions necessary for maximum coverage. These revised locations shall be shown on system one-line diagrams.

- b. All wiring connections at each component including splicing or terminations at junction or pull boxes.
 - c. Testing of wiring prior to connection to verify system is free of grounded or open circuits.
 - d. Complete system operational test. Each component shall be shown to operate at least three times without malfunction.
 - e. Owner demonstration of system operation. This shall be accomplished when directed by the Architect and shall include all system operational features.
 - f. Written verification of the above submitted to the Architect at job acceptance. Verification to include signed statement from Owner that system was demonstrated to Owner's satisfaction.
3. A complete one-line diagram of each system shall be prepared by the company who supplies the components. This diagram shall show each component, all interconnecting wiring with wire size and conduit size, numbering of all terminal strips, all pull or junction boxes, zones and/or device addresses where applicable and any other information which is deemed necessary by the Architect. The one-line diagram shall be done with drawing instruments so as to be neat, legible and all lettering upper case. CAD drawings may be used. Diagram to be drawn on reproducible (tracing, sepia or auto-positive) unless size will allow use of standard letter-size bond paper. Diagram shall be done at half-size when footprint exceeds 11" x 17" paper size.
4. System wiring, though not shown on the drawings, shall be furnished and installed in accordance with the intent of the plans and specifications and the one-line diagram. It shall be in conduit, unless otherwise noted. Type, size and number of cables shall be in accord with manufacturer's recommendations.
5. System component locations shown on the drawings are for estimating purposes only. Actual locations shall be coordinated with the architectural finishes encountered, other equipment, and structural elements, and shall be properly located for maximum system performance. Furnish all necessary mounting accessories for area involved.

- END OF SECTION 16600 -

16610 FIRE ALARM AND DETECTION SYSTEM

A. GENERAL

1. Shall be installed in conduit. Conduit and wiring though not shown on drawings shall be provided by the contractor to accomplish the intent of the system as shown on the drawings by symbols and this specification.
2. The Fire Alarm and Detection System(s) and its/their installation shall comply with the latest revisions all applicable codes and standards including International Building Code (IBC), National Fire Protection Agency (NFPA), National Electrical Code (NEC), Americans with Disabilities Act (ADA).
3. Provide all equipment, accessories, material, and labor required to install and connect in accordance with these specifications and applicable drawings for fully operational Fire Alarm and Detection System to the complete satisfaction of the Architect. All material and/or equipment necessary for the proper operation of the system not specified or described herein shall be deemed part of the specifications and shall be provided by the Division 16 contractor.
4. See Section 16600 "SPECIAL SYSTEMS" for additional requirements.
5. The installed and/or modified Fire Alarm and Detection System(s) and all associated devices and connections shall be tested in accord with the manufacturer's recommendations, applicable codes and standards, and testing guidelines as herein specified. Testing shall be performed by an independent, third-party company qualified to test the system involved. Testing company qualifications shall be submitted to the Architect for approval prior to the beginning of testing.

A full test report as outlined in this specification shall be submitted to the Architect in writing prior to substantial completion. Where System(s) operations involve other Divisions of the Specifications, the affected Professional shall verify by signed written statement that the operation was correct and complete. Retesting as necessary to achieve a complete report(s) with no deficiencies shall be required. The Architect/Professional will perform random component testing at substantial completion. Should any part of the System(s) not perform correctly, a complete re-test of the entire System(s) can be required with no additional or increase in Cost to the Owner. If more than one re-check of the System(s) by the Architect/Professional is required to verify proper System(s) operation, the Contractor will be billed for the time and expense of the Architect/Professional.

B. INSTRUCTIONS

1. Fire Alarm System shall consist of an addressable microprocessor based voice control panel with 80 character LCD display, addressable alarm initiating devices, visual and audio/visual alarm devices, remote annunciator and a fully supervised wiring system for a complete fire alarm system.

2. Each component of the system shall be listed under the appropriate category(ies) by Underwriters' Laboratories, Inc. (UL). The complete system installation shall conform to the applicable sections of NFPA-72, NEC 760, and Local Code requirements. All components and control panel(s) shall be by the same manufacturer.
3. Control Panel(s). Control panel(s) shall be configured and contain all hardware/software/power to supervise, monitor and control all devices connected plus an additional 25% spare capacity. The control panel(s) shall be expandable to a minimum point capacity as listed in the itemized equipment list. Control panel(s) shall contain power supply(ies), size and number as required for proper system operation for the number of devices and components connected plus 25% spare capacity.

Standby battery(ies) shall be maintenance free, sealed type complete with metered charger(s) and shall be provided and connected as required to operate the complete system for 60 hours. Battery charger(s) shall be rated for recovery of batteries from full discharge to full charge in 24 hours or less.

Main control panel shall be equipped with a drill switch which when activated shall cause only the general alarm audible and visual signals to activate but no other general alarm functions shall be affected. Operating software shall include "walk test", event historical log, operator "password" access levels (minimum four) and addressable device custom labeling.

System(s) programming shall be provided by certified manufacturers technician(s) and shall be customized for the facility(ies) in which the system(s) is/are installed. Addressable device labels shall be programmed for plain language readout per the direction of the Owner/Architect. Device labels shall include associated room numbers in which the device is located and the room numbers shall be taken from the final room number designations issued by the Owner/Architect.

Visual alarm indications shall not be canceled by the operation of an audible alarm silencing means. Cancellation of visual alarm indications shall be by Reset of the Fire Alarm System only. Activation of any device shall not interfere with the normal operation, subsequent activation and/or alarm operation of any other connected component due to system design, wiring or power limitations.

An internal dual line DACT module shall be provided and connected to nearest active telephone system termination point using (2) 24 gauge, 4 pair, category 5 UTP cables in 3/4" C. If campus is set up with dedicated fiber network for fire alarm monitoring, then provide network card and provisions for fiber cabling and connections to be completed by others.

4. Remote Annunciator(s). Shall be provided and connected where shown on the drawings or at the facility's main entrance where directed by the Architect if location not shown. Shall contain 80 character LCD display. Displayed information shall include point address, point status (alarm, trouble, etc.), alarm type (smoke detector, manual station, etc.), number of system alarms, supervisory conditions and troubles, and a custom device location label. Alarm, supervisory and trouble conditions shall be indicated by dedicated LEDs and an audible signal. "Alarm Silence" and "System Reset" switches shall be provided. All switches on the annunciator shall be controlled by an "enable" key switch with the key removable in the "disable" position only.
5. System wiring shall be Class B as defined by NFPA. Any system circuit wiring ground or open, or any system component failure shall cause associated trouble signals to operate. System components shall be protected against transient over voltages by metal oxide varistor.
6. Actuation of any initiation device shall cause the following actions:
 - a. Activate general alarms (audible and visual).
 - b. Display individual initiating device address and description at control panel(s) and remote annunciator(s).
 - c. Provide activation signals and interfaces to other systems as herein specified.
 - d. Transmit signal over telephone lines to central fire reporting station via communicator. Furnish all necessary hardware required to accomplish this function and coordinate installation including, if required, proper polarity reversing relays.
7. Alarm Devices. Audible/visual and visual alarm devices shall be provided and connected throughout the facility(ies) properly located as to produce audible and visual alarms in accordance with NFPA 72 and ADA. Audible/visual devices provided in corridors shall be located within 15 feet of each corridor end and at a spacing no greater than 50' in between. Visual alarm devices shall be provided and connected as shown on the drawings and in each restroom, classroom, meeting/conference room, filing/work room, dressing/locker room, examination room and similar rooms/spaces. Visual alarm devices provided in rooms (with the exception of corridors/hallways) whose effective rectangular (length X width) dimensions (measured from the longest points) exceed 20'LX20'W shall have a light output of 110 candela. Visual alarm devices in corridors and other spaces shall have a light output of 15 candela unless noted otherwise on the drawings.
8. Manual Pull Stations. Shall be provided and connected at all exterior exit doors and in each corridor where required to limit spacing between devices to 200 feet. Shall be provided and connected at central security station. Shall be non-coded, addressable double action - push type with housings and levers of high-impact Lexan or cast metal. Each pull station shall be provided with a clear Lexan protective shield with integral sounder.

9. System Heat Sensors and Bases. Shall be analog type fixed temperature and rate-of-rise 135 degree, addressable and shall be provided as shown on the drawings and/or as specified herein. Detectors requiring control interface with external systems (i.e. air handling units, etc.) shall be provided with all required NC & NO contacts or zone addressable control module(s) which shall be used by other Sections of these specifications. The operation of each contact shall be programmable at the control panel.
10. Duct Mounted Smoke Detectors. Shall be analog photoelectric type smoke sensors including addressable duct housings, sampling tubes, etc. and shall be provided and properly installed in air handling duct systems in the following locations:
 - a. In the main supply duct on the downstream side of filters and in the return duct prior to exhausting from the building or diluted by outside air of all air handling units.
 - b. Air unit side of all smoke dampers.

Review Division 15 plans and specifications for air handling unit locations and areas served. The detectors shall be provided with all required NC & NO contacts or zone addressable control module which shall be used by Division 15 Contractor for air handling unit shut down. The operation of each contact shall be programmable at the control panel. Programmable detector base(s) and/or proper zone addressable control module(s) shall be provided as required. Wiring and connection requirements for air handling unit shut down shall be the responsibility of the Division 15 Contractor. Each duct detector shall be provided with a remote alarm and test station installed as directed by the Architect or as shown on the drawings.

11. Fire Protection System(s). Proper alarm initiating devices with required associated equipment shall be provided and connections shall be made to monitor each required component of the fire protection (sprinkler) system, including wiring supervision. Connections shall include all flow indicating switches, post indicator valves (PIVs), wall indicator valves (WIVs) and OS&Y valves. Operation of flow indicating switch(es) shall cause a general alarm and closing of PIVs/WIVs or OS&Y valve shall initiate a supervisory signal. Each flow switch and supervisory indication shall have a separate address.
12. Smoke Dampers. Provide and connect power connection(s) properly matched for voltage and capacity to each smoke damper installed under Division 15. Provide proper fire alarm system connection including addressable control modules as required to each smoke damper. The fire alarm system shall maintain the dampers in the open position through proper interface with the damper control device(s) until a general alarm signal is received. Upon receipt of a general alarm signal, the fire alarm system shall initiate the closing of all dampers through proper interface with the damper control device(s). Dampers shall return to the open position when the fire alarm system is reset.
13. Door Hold Open Devices. Provide and connect door hold open device(s) at each smoke door and/or as shown on the drawings. The Fire Alarm System shall provide the proper power connection (matched for voltage and capacity) and control for the smoke door hold open devices. System smoke detectors, photoelectric type, as specified herein shall be provided and connected at each smoke door location on each side of the door. Upon any alarm activation of the System, the associated door(s) shall be released to close.

14. Exit Door Release. Provide proper Fire Alarm System control device and connection(s) including wiring supervision to all devices and/or systems intended to effect the locking/unlocking of emergency exit doors. Upon any alarm activation of the System, provide proper signal to each device and/or system to unlock all emergency exit doors. Provide addressable control modules as required.
15. Elevators. Smoke sensors as herein specified shall be installed in all elevator lobbies, machine room(s) and hoistway(s). Smoke sensors shall interface with the elevator controller(s) via addressable control module(s) provided as required to indicate activation of any sensor at any level other than the "designated" level. A second signal shall be provided to the elevator controller(s) to indicate activation of the detector at the "designated" level only.
- Heat sensors as herein specified shall be installed in elevator machine room(s) and hoistway(s). Heat sensors shall interface with electrical power distribution system via addressable control module(s) to automatically control the shunt trip of associated elevator power and control circuit breakers prior to the application of water in the hoistway(s) and/or machine room(s). Division 16 contractor shall coordinate detector activation temperature with Fire Protection Contractor and shall activate shunt trip of required power sources prior to the application of water in the elevator spaces.
16. A service contract offering continued factory authorized service after the contract provided one (1) year parts and service warranty of the installed system shall offered in writing and be made available if requested by the Owner.
17. System components shall be the following as manufactured by Simplex or equal in Pyrotronics, Notifier, Edwards or approved equal. Quantities shall be as shown on the drawings or as defined in this specification and/or as required for proper system operation per the drawings and this specification. All cables shall be as recommended by the system manufacturer or exact equal.

<u>ITEM</u>	<u>CAT. NO.</u>	<u>BOX</u>
TrueAlarm System Control Panel with 1000 Point MAPNET Controller Voice Alarm Control Panel	4100-8001	----- -----
Remote 80 Character LCD Annunciator with Trim Plate	4603-9101	6 gang
MAPNET II Addressable Pull Station, Single Action	2099-9795	4" sq. X 2 1/8"D w/1gg raised cover
MAPNET II Addressable Pull Station, Double Action	2099-9761	4" sq. 2 1/8"D w/1gg raised cover
Trim for Pull Station	2099-9813	-----
Trim for Pull Station (surface mount Wiremold box)	2099-9814	-----
Protective Shield w/Sounder	2099-9815	-----
Pull Station Wire Guard	2099-9800	-----

Audible/Visual Alarm Device (110cd)	4903-9238	4" sq. X 1 1/2"D
Audible/Visual Alarm Device (15cd)	4903-9236	4" sq. X 1 1/2"D
Visual Only Alarm Device (110cd)	4903-9136	4" sq. X 2 1/2"D w/1gg raised cover
Visual Only Alarm Device (15cd)	4903-9136	4" sq. X 2 1/2"D w/1gg raised cover
Wire Guard Audio/Visual Alarm Device	4905-9927	-----
TrueAlarm Photoelectric Smoke Sensor	4098-9714	-----
TrueAlarm Heat Sensor	4098-9733	-----
Carbon Monoxide Sensor	CM-15 (Macurco)	4" octagon
Single Station Photoelectric Smoke Sensor	2098-9694	4" octagon
Single Station Photoelectric Smoke Sensor w/Strobe	2098-9673	4" octagon
TrueAlarm Base	4098-9792	4" oct. X 2"D
TrueAlarm Base with Piezo	4098-9713	4" oct. X 2"D
TrueAlarm Base with Relay Output	4098-9791	4" oct. X 2"D
TrueAlarm Duct Housing with Software Programmable Relay and Baffle	4098-9753	-----
49" Sampling Tubes	2098-9797	-----
TrueAlarm Sensor for Duct Housing	4098-9714	-----
Remote LED Alarm/Test Station	2098-9806	switch
24VDC Wall Mount Door Holder	2088-9608	4" sq. X 2"D w/1gg raised cover
Internal dual line DACT module	4100-0153	-----
Monitor ZAM with Surface Cover	2190-9155	4 11/16" sq. w/ext. ring
Signal ZAM with Surface Cover	2190-9161	4 11/16" sq. w/ext. ring
Control ZAM with Surface Cover	2190-9163	4 11/16" sq. w/ext. ring
Individual Addressable Module (IAM)	2190-9172	4" sq. w/1gg raised cover

FIRE ALARM SYSTEM INSPECTION/TEST REPORT ON FOLLOWING PAGES

- END OF SECTION 16610 -

FIRE ALARM SYSTEM INSPECTION/TEST REPORT

I. Testing Organization

Company Name: _____ Test Date: _____

Representative: _____ Title: _____

Telephone Number: _____ Fax Number: _____

		YES	NO
1	Prior to starting this test, has the Testing Organization been approved by the Professional?		

II. Project Information

Project Name: _____ W/O Job No.: _____

Project Address: _____

III. System Information

Fire Alarm System Manufacturer: _____

Model No.: _____ Serial No.: _____

Installed Software and Revision: _____

IV. Test Requirements

The system shall be tested by a representative of the testing organization and all test results shall be reported as witnessed by him. A negative answer to any of the following questions shall be explained in sufficient detail on a separate typed document.

A. General.

		YES	NO
1	Installed Fire Alarm and Detection System(s) and all associated equipment, devices, etc. are as submitted in the approved Shop Drawings?		
2	All devices, equipment, etc. have been installed correctly per the manufacturer's recommendations and the Contract Documents?		
3	All devices, equipment, etc. have been installed at the approximate locations and mounting heights as shown in the Contract Documents?		
4	After silencing of audible alarm, all visual alarm devices continued to operate until the System was reset?		

5	All wiring has been tested for shorts, grounds and open circuits?		
6	All alarm and initiating devices have been tested for proper operation and have been made to properly operate at least twice? Properly complete attached initiating test for each initiating and supervision device.		
7	Alarm and trouble indication is properly annunciated at control panel(s) and remote annunciator(s) for all connected initiating devices by address, description and location?		
8	Initiating device descriptions and locations as indicated at control panel(s) and remote annunciators(s) adequately describe and located the devices within the building?		
9	Installed battery back-up properly provides power to maintain proper system operation when the normal power source is de-energized?		
10	The installed automatic dialer properly operates?		
11	All single station smoke detectors have been tested for proper operation and have been made to properly operate at least twice?		

B. Interface with HVAC System(s).

A representative of the Division 15 Professional shall witness all functions of the HVAC system(s) which are initiated by and interfaced with the Fire Alarm System(s). The Division 15 Professional shall provide a signed statement of proper system operation as outlined in the Contract Documents and a copy of this statement shall be attached to this report when submitted for approval.

YES NO

1	All duct mounted smoke detectors have been installed per the manufacturer's recommendations and per the Contract Drawings?		
2	Upon smoke detection by the duct mounted smoke detectors in each duct system, the proper air handling unit equipment shut down to the satisfaction of the Division 15 Professional?		

C. Interface with Fire Protection System(s).

A representative of the Division 15 Professional shall witness all functions of the Fire Protection System(s) which are supervised by and interfaced with the Fire Alarm System(s). The Division 15 Professional shall provide a signed statement of proper system operation as outlined in the Contract Documents and a copy of this statement shall be attached to this report when submitted for approval.

		YES	NO
1	Fire Alarm System connections have been made to all Fire Protection System supervisory devices (PIV, tamper switches, flow switches, etc.) and the Fire Alarm System recognizes each device connection?		
2	Operation of PIV or tamper switches causes a trouble signal at the Fire Alarm System and was properly annunciated at the control panel(s) and the remote annunciator(s)?		
3	Operation of the flow switch(es) causes a general alarm of the Fire Alarm System and was properly annunciated at the control panel(s) and the remote annunciator(s)?		
4	The proper time delay between each flow switch(es) activation and initiation of the Fire Alarm System general alarm was observed?		

D. Interface with Elevator Control System(s).

A representative of the Division 14 Professional shall witness all functions of the Elevator Control System(s) which are initiated by and interfaced with the Fire Alarm System(s). The Division 14 Professional shall provide a signed statement of proper system operation as outlined in the Contract Documents and a copy of this statement shall be attached to this report when submitted for approval.

		YES	NO
1	Smoke detectors are installed in each elevator lobby, in the elevator equipment room(s) and at the top of the elevator shaft(s)?		
2	Heat detectors are installed in the elevator equipment room(s) and at the top of the elevator shaft(s)?		
3	If the building has a fire protection system (sprinkler system), the Fire Alarm System initiates the shunt-trip of the circuit breakers serving the elevator equipment prior to water flow?		
4	Upon detection of smoke in the elevator lobby on any floor of the facility the Fire Alarm System provides the proper signal to the Elevator controller(s).		

E. Interface with Door Access Control System(s)

		YES	NO
1	When a Fire Alarm System general alarm has been initiated, all exit-way doors controlled by electronic locking mechanisms were released to allow exiting from the facility?		

INITIATING AND SUPERVISORY DEVICE TEST LOG
(make copies as required)

Device Address	Device Type	Device Location	Visual Check	Functional Check	Pass	Fail
_____	_____	_____	()	()	()	()
_____	_____	_____	()	()	()	()
_____	_____	_____	()	()	()	()
_____	_____	_____	()	()	()	()
_____	_____	_____	()	()	()	()
_____	_____	_____	()	()	()	()
_____	_____	_____	()	()	()	()
_____	_____	_____	()	()	()	()
_____	_____	_____	()	()	()	()
_____	_____	_____	()	()	()	()
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_____	_____	_____	()	()	()	()
_____	_____	_____	()	()	()	()
_____	_____	_____	()	()	()	()
_____	_____	_____	()	()	()	()
_____	_____	_____	()	()	()	()
_____	_____	_____	()	()	()	()

Comments: _____

The above test report for the Fire Alarm and Detection System(s) is true and accurate to the best of my knowledge and per my system(s) testing and inspection, and the Fire Alarm and Detection System(s) appears to be properly operating per the Contract Documents for this project.

Signature: _____ Date: _____

Print Name: _____ Title: _____

End of Fire Alarm System Test Report

16620 TELECOMMUNICATION STRUCTURED RACEWAY SYSTEM

1. General

A Codes and Standards

1. Shall be a telecommunication raceway system(s) as shown and/or noted on the drawings and herein specified. The structured raceway system though not shown on the drawings shall be furnished and installed by the contractor to accomplish the intent of the system as shown on the drawings by symbols and as herein specified.
2. Applicable requirements listed in the following sections shall apply: Section 16110 "Raceways and Fittings", Section 16160 "Boxes and Fittings" and Section 16500 "Telephone/Data System - Raceway only."
3. All work shall comply with the applicable codes and standards as issued by NEC, ANSI/EIA/TIA, BISCII, IEEE, UL and NFPA.

B Scope of Work

1. The Contractor shall furnish all equipment, material and labor required to provide and connect in accordance with this specification and applicable drawings a complete Structured Telecommunication Raceway Distribution System, hereinafter referred to as the "System" in this section of the specifications, to the complete satisfaction of the Professional.
2. It is the intent of the drawings and this specification to provide a complete and operational System ready for the Owner's network switches, hubs, routers, etc. All equipment, accessories and/or material necessary for the proper operation of the System as herein specified not specified or described herein but normally provided in similar systems shall be deemed part of the specifications and shall be provided by the Contractor. Generally, the structured raceway system shall include conduit, boxes, cable tray, plywood backboards and other miscellaneous materials.

2. Products

A Outlet Plates

1. Telecommunication outlet plates shall be of the same material as specified for power wiring devices in Section 16160 "Boxes and Fittings". Work area outlet plates shall have the proper number of knockouts as required for the receptacles to be installed and/or two receptacle knockouts minimum. Provide blank cover on unused plate knockouts.

3. Execution

A Raceway

1. Telecommunication raceways shall be as shown on the drawings, as specified in Section 16500 "Telephone/Data System - Raceway Only" and the requirements listed herein.

2. Telecommunication raceways shall be routed in compliance with the following requirements:
 - a. Raceways shall be routed in corridors, where possible, consistent with the requirements as listed herein.
 - b. Conduit routing shall avoid arcing or rotating electrical equipment, transformers and/or ballast and any type of signal transmitting equipment. Maintain recommended clearance from any interference source given the cable installation method/media (conduit, tray, J-hooks, open, etc.)
 - c. Where future cables are to be routed open (without a conduit or other raceway system), provide cable supports (i.e. J-hooks, etc.) whether or not shown on the drawings or specified herein. Cable supports shall be mounted independent of the ceiling support system and spaced as recommended by the cable manufacturer and at a maximum of 5 feet on center.
 - d. Conduit shall be routed parallel and perpendicular to walls, ceilings and/or floors where possible. Conduit homeruns from a common area and terminating at a common backboard or termination rack shall be group together. All conduits shall be installed in a neat and workmanlike manner.
 - e. Provide a telecommunications vertical grounding bus bar in each closet.
 - f. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays and all associated hardware entering or residing in the rack shall be grounded to the respective ground bus bar using appropriate industry standard bonding conductor connectors.
 - g. All wires used for grounding shall be of a like easily identifiable color, agreed upon by the Owner. All grounding wires and bus bars shall be identified and labeled per the Owner.

- END OF SECTION 16620 -

16630 AUDITORIUM DIMMING AND CONTROL SYSTEM

PART 1 - GENERAL

1.01 Related Documents

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.
- B. Refer to the Contract Drawings for plans, graphic representations, schedules, and notations showing Stage Equipment Work.

1.02 Governing Clause

- A. For the sake of brevity, these Specifications shall omit phrases such as Contractor shall furnish and install", "unless otherwise indicated or specified", etc., but these phrases are nevertheless implied. Mention of materials and operations requires the Contractor to furnish and install such materials and perform such operations completely to the satisfaction of the Owner and Architect.

1.03 Scope of Work

- A. One company shall be responsible for the installation of all aspects of the stage equipment. Work under this Section shall include the furnishing of all labor, materials, tools, transportation services, supervision, etc., necessary to complete installation of new stage equipment as well as any other items as herein listed, all as described in these Specifications, as illustrated on the accompanying Drawings.
 - (1) Provide and install one motorized light hoist system for stage electrics.
 - (2) Provide house lighting, stage electric, dimming, control, and power distribution equipment to electrical contractor for installation (some components to be installed by theatrical equipment or controls contractor, some by electrical contractor).
 - (3) Provide coordination, commissioning, and training.

1.04 Contractor's Qualifications

- A. The Contractor shall be fully experienced in the fabrication and installation of the stage equipment specified. The Contractor shall have been in business for a minimum of five (5) full years preceding the date of this bid doing work similar to the type specified and under the same name. The Contractor shall employ only fully trained stage riggers and mechanics for the erection of the stage equipment. The stage riggers shall be completely familiar with the type of equipment to be installed. A competent Job Superintendent shall be on the job at all times when Work is in progress.

1.05 SUBSTITUTIONS

A. Delivery, Storage and Handling

- (1) Product storage and handling requirements in accordance with manufacturer's recommendations.
- (2) Accept metal fabrications on site in labeled shipments. Inspect for damage.
- (3) Protect metal fabrications from damage by exposure to weather.

B. Field Measurements

- (1) Verify field measurements are as indicated on shop drawings.
- (2) Specific items of equipment are specified by trade names. It has been determined by the Architect that these are the particular items desired by the Architect and established a standard of quality, equipment function and/or process. It is not the purpose nor intent of these Documents to eliminate competitive bids. Architect's approval of a substitution for bid purposes will not relieve the Contractor from the responsibility of meeting all Specifications criteria. If an approval of a substitution is granted, the Contractor shall be fully responsible for any and all changes (wiring, power, distribution, support structure, etc.) such substitution shall require.

1.06 Defective or Non-Approved Materials

- A. Should any stage equipment be found defective, not meeting Specifications, or that which has not been approved in writing by the Architect shall, upon discovery (including any time within the period of the guarantee), be replaced with the specified equipment or material at no additional cost.

1.07 GUARANTEE

- A. The Contractor shall guarantee all of the Work that is performed under this Contract, including all materials, and workmanship, for a period of one (1) year from the date of Substantial Completion of the Work. Lamps for lighting fixtures shall be guaranteed against failure for thirty (30) days.
- B. Nothing in this guarantee shall cause repair or replacement by the Contractor where negligence, neglect or improper operation by the Owner has caused the failure of any equipment installed under this Contract.

1.08 DISCREPANCIES

- A. All equipment shall be sized to fit properly. The exact measurements are the responsibility of the Contractor. If there are discrepancies in the Specifications, the Contractor shall ask for a clarification from the Architect. If no clarification is requested, the Architect's judgment shall rule.

1.09 System Integrator

- A. The Contractor shall be responsible to utilize a System Integrator to coordinate and assist in the installation of all aspects of the stage equipment as specified in this section. This shall include but not be limited to all motorized hoists/controls, theatrical/house dimming, and and miscellaneous equipment. The following companies have prior approval as System Integrator:

- (1) Mainstage Theatrical Supply, Inc., Pensacola, Florida.

- (2) Theatrical Lighting Systems, Huntsville, Alabama

- B. The System Integrator shall employ only fully trained stage riggers and mechanics, assisted by common laborers, for the erection of the stage equipment. The stage riggers shall be completely familiar with the type of equipment to be installed. A competent job superintendent shall be on the job at all times when work is in progress.

1.10 Acceptable Equipment Manufacturers

- A. For the purposes of establishing a standard of quality desired on this project. The dimming and control products of Lutron are specified.
- B. The electrical stage distribution hardware of Electronic Theatre Controls of Middleton, Wisconsin is specified.
- C. The pendant fixture lowering system of Lighting and Lowering Systems is specified.
- D. All other companies shall provide equal products, as accepted. Please refer to the section regarding substitutions.

1.11 Documentation

- A. Shop Drawings: Shop drawings and equipment data sheets shall be submitted to the Architect. Approval of submitted equipment shall be obtained prior to equipment purchasing or fabrication. If shop drawings are rejected, correct and resubmit in the manner as specified. All shop drawing information shall be submitted at the same time; no partial submittal will be accepted. Drawings shall indicate complete details, dimensions, product types and locations of all equipment, clearances required, guides, cables, sets, Contractor fabricated equipment, and all other details required to completely describe the work to be performed. Shop drawings shall be presented at a scale of not less than 1/8" = 1'-0" for conduit plans, 1/4" for equipment layouts, 1/2" = 1'-0" for mounting details, and 1/2" = 1'-0" for plate and panel details. Each

sheet to allow space for approval stamps and have the name of the project, the Contractor and/or the supplier's name, address telephone number, and the date submitted. Submit the following items for approval, prior to fabrication:

- (1) Electrical riser diagrams indicating the necessary control wiring for all dimming, distribution, and controls wire tag number for every connection. Show all terminal blocks with wire numbers and location.
- (2) Plan and elevation views indicating all electrical hardware locations and layout.
- (3) Provide full dimensions for panel layouts with finishes and materials for all custom panels.
- (4) Details of installation and erection, including adjoining conditions and necessary clearances.
- (5) Indication by arrow and boxed caption of each variation from Drawing and Specifications, except those indicated as acceptable in Specifications or on Drawings.

B. Record Drawings and Data: Submit within 30 days of final test and completion of the installation, submit the following:

- (1) Three (3) complete sets of "Record" Drawings (rolled, not folded showing systems and elements as installed, including field modifications and adjustments.
- (2) Three (3) sets of maintenance data including a list indicating replacement parts lists for all items of equipment, wiring diagrams, control diagrams, any and all keys for cabinets, racks, key operated switches etc. and complete operation manuals.
- (3) Three (3) Certificates of Guarantee
- (4) Electrical distribution drawing of the theatre in plan view (1/4" = 1'-0") indicating all electrical outlets and their corresponding circuit number dry-mounted to foam board and framed under non-glare glass and mounted on the wall in the control booth.

1.12 Delivery, Storage and Handling

- A. Product storage and handling requirements in accordance with manufacturer's recommendations.
- B. Accept metal fabrications on site in labeled shipments. Inspect for damage.

- C. Protect metal fabrications from damage by exposure to weather.

1.13 Instruction of Owner Personnel

- A. This Contractor, or his representative, fully knowledgeable and qualified in systems operation, shall provide eight (8) hours of instruction to the Owner-designated personnel on the use and operation of this System. Designated instruction times shall be arranged through the Owner.

1.14 Clean Up

- A. It shall be the responsibility of the Contractor to remove all debris from the building or site caused by his operations to a common trash point or receptacle on the job site, as determined by the Architect.

PART 2 PRODUCTS

2.01 Theatrical and Lowering Rigging Equipment

A. General Standards

- (1) Paint as required under this section shall be the manufacturer's standard finish and color except as noted.
- (2) All equipment items shall be new and conform to applicable provisions of Underwriters' Laboratories and American Standards Association.
- (3) Where acceptable equipment items are specified by catalog number only, device shall meet all published manufacturer's specifications. Where quantities are not given, refer to drawings. Where two or more products are listed, contractor may use either, at his discretion. Equipment shall not be substituted without specific written approval by the Electrical Engineer/Engineer's Representative under the substitution paragraphs of these specifications.

B. General Rigging Standards

- (1) All pipe battens shall be fabricated from 1.5" schedule 40 pipe.
- (2) All turnbuckles, clips, tracks, chains and other items of incidental hardware shall be furnished plated or painted. Wire rope shall be galvanized. Fasteners, chain, and other miscellaneous hardware shall be either cadmium or zinc plated.
- (3) All materials used in this project shall be new, unused and of the latest design. Refurbished materials are not permitted.

- (4) In order to establish minimum standards of safety, a minimum factor of 8 shall be used for all equipment and hardware used on this project. In addition, the following factors shall be used:

Cables and fittings	8 Safety Factor
Cable bending ratio	30 times diameter
Max. fleet angle	1 1/2 degrees
Steel	1/5 of yield
Bearings	Two times required load at full for 2000 hours

2.02 Low Profile Hoist

A. General

- (1) Low Profile Hoist shall be purpose-designed and fabricated for overhead lifting of theatre lights. The systems shall incorporate mechanical, electrical and safety features that shall be inherent to this equipment and shall provide an engineered, efficient device for overhead lifting. The mechanical, electrical and safety features of this hoisting and control system shall establish the standard of quality, performance and safety by which hoisting systems of other manufacture shall be evaluated.
- (2) Each wire rope lift line shall adhere to a design factor of 10:1 with an ultimate strength of 4200 pounds. All load path components between the building structure and the batten shall exceed the breaking strength of the wire rope. The motor brake shall be rated at least at 150% of the motor torque.
- (3) The standard configured P1000E hoist for Stage/FOH loads shall be capable of supporting a live load of up to 1000 pounds suspended from the pipe batten.
- (4) The standard hoist shall consist of the following major components: 1) powerhead, 2) compression tube with beam clamps, cable management system, loft blocks, lift line and lift line terminations and 3) pipe batten and power/control distribution strip.
- (5) The hoist shall include the following features:
- (a) A powerhead containing the gearmotor, motor brake, load brake, limit switches operating electronics, load sensor, slack line detector and wire rope.
 - (b) The powerhead shall be no larger than 18" wide x 14" high x 55" long.
 - (c) The powerhead shall weigh no more than 400 pounds.

- (d) A compression tube structure shall prevent any lateral forces from transferring to the building. Hoists or hoisting systems that impose a lateral load on the building structure shall not be acceptable for this project.
- (e) The hoist shall incorporate a built-in load cell.
- (f) The hoist shall incorporate a built-in slack line sensor.
- (g) The hoist shall incorporate the emergency contactor.
- (6) The hoist shall be manufactured from UL Listed components and shall be UL Listed and tested as a complete system (not just UL listed parts).

B. Powerhead

- (1) The powerhead shall be a fully enclosed sheet metal housing which shall prevent contact with moving and electrical parts and shall provide protection against dirt, dust and debris collecting on the operating parts of the machine, the electrical and electronic components and the wire rope lift lines on the lifting drum.
- (2) The powerhead housing shall be fabricated from powder coated sheet metal. It shall be punched and formed to enclose and support the gearmotor, motor brake, load brake, limit switch assembly, limit switch adjustment system, reversing contactor, emergency contactor, wire rope drum, wire rope (cable) keeper, load cell, slack line detector and motor electronics.

C. Gearmotor and Motor Brake

- (1) The gearmotor and motor brake shall be an integral unit from a single manufacturer. It shall produce 1.5HP for Stage/FOH and shall operate on 208 volt, 60 Hz, 3 phase power.
 - (a) The gearmotor shall operate the hoist at a fixed speed yielding a line speed averaging 30 feet per minute.
 - (b) The gearmotor shall drive a monolithic double output shaft that extends from each side of the gearbox through the support bearings without couplings.
 - (c) The integral motor brake shall be spring applied and electrically released.
 - (d) The brake shall be capable of holding 150% of the motor full load torque.
 - (e) On one side of the gearbox, the Prodigy Hybrid Drum™ shall be mounted. Up to eight 3/16" dia. 7 x 19 wire ropes, ASTM Specification 81023/A1023M-02, commonly referred to as galvanized aircraft cable, shall be wrapped on that drum.
 - (f) The portion of the shaft protruding from the opposite side of the gearbox

shall support the load brake.

D. Load Brake

- (1) The rotary disk load brake shall bring the moving load to a complete stop and shall hold the load in position in the event of a mechanical failure of the motor, motor brake or gearbox.
 - (a) The load brake shall not generate noise at any time in the operational cycle.
 - (b) At no time shall normal hoist operation be limited by heat or noise caused by the load brake.
 - (c) The load brake shall be mechanically released when the load is moving in the up direction. The load brake shall always be engaged when the load has stopped moving either up or down. When lowering the load the Load Brake shall partially disengage to allow movement. In the absence of rotational torque on the gearbox, the load brake will not release.

E. Wire Rope Drum

- (1) The Prodigy Hybrid Drum™ shall allow the lift lines to be wrapped in a compact manner that prevents wire rope damage.
 - (a) A wire rope shall not cross over other wire ropes, nor lie vertically on top of another wire rope nor be allowed to stack in a single pile as on a yoyo drum.
 - (b) The drum shall have been tested for wear, durability, strength, service and integrity by an independent testing lab.
 - (c) The sloped drum shall be capable of safely wrapping up to eight pieces of 3/16" diameter wire rope lift lines.
 - (d) An assembly of wire rope (cable) keepers shall assure that the lift lines wrap appropriately on the drum.

F. Limit Switch

- (1) The limit switch assembly shall be mounted within the powerhead. The limit switch shall establish hard "normal" end of travel limits and hard "ultimate" end of travel limits for movement in either direction. In addition, software shall establish resettable "normal up" and "normal down" end of travel limits, typically redundant for the normal end of travel limits. This combination of hard limits and soft limits shall provide each hoist with a total of three "up" and three "down" limits to assure that the hoist does not exceed the maximum allowable travel in either direction.

- (a) The hard end of travel limits shall be set or adjusted at the time of installation via a screw adjustment on the bottom/rear of the powerhead cover.
- (b) An indicator light shall be visible on the bottom panel of the powerhead cover and shall illuminate when the setting screw is adjusted to the current position of the batten.
- (c) Any system that indicates that the limit has been set by audible or tactile means only shall not be acceptable.

G. Slack Line Detector

- (1) The slack line detector shall be built into the hoist. When a slack line condition develops, the slack line detector shall remove power from the hoist and prevent hoist movement.

H. Cable Management

- (1) The load circuits and control wiring shall be fed to the hoist by a built-in cable management system that allows the flat feeder cable to fold and store along the top of the connector strip. At high trim, the entire system shall be store in no more than 30" of vertical space.
- (2) The cable management system shall be integral to the hoist system. Hoisting systems utilizing cable management systems from third-party vendors shall not be acceptable for this installation.

I. Compression Tube and Beam Clamps

- (1) The compression tube shall be a continuous channel of extruded aluminum engineered to neutralize the horizontal forces on the building. The tube shall support the loft blocks mounted within the spacing limits of the system. Compression tube sections shall be joined into a continuous assembly by dedicated splicing plates at each tube joint.
- (2) The tube shall be installed only by means of dedicated beam clamps that allow the compression tube to snap into place. Beam clamps shall be capable of attaching to horizontal beams, joist flanges or flat steel plates measuring from 3/8" thick up to 1" thick and from 4" wide up to 14" wide.

J. Loft Blocks

- (1) Each loft block shall be an assembly of steel side plates, a wire rope idler, sheave and support hardware. Each loft block shall be inserted into a slot on the bottom of the compression tube. The blocks shall be positioned in the compression tube within 6'-0" of a beam clamp, and no closer than 3'-0" from each other
- (2) Loft blocks shall measure 5" in diameter and contain a pair of press fit

sealed ball bearings. Lift lines shall travel in a groove shaped and sized for 3/16" diameter wire rope per the latest edition of the Wire Rope Users' Manual as published by the Wire Rope Technical Board. The loft block sheave shall be concentric about the hub and shall be evenly balanced for ease of rotation.

- (3) An idler shall be incorporated into the top assembly of the loft block to guide and support lift lines as they pass the block. Hoisting systems requiring the loft blocks to be mounted directly to the facility steel shall not be accepted for this project.

K. Hangers

- (1) Raceway hangers shall be specially shaped flat bar that shall support the wire rope termination hardware and secure the raceway and the pipe batten.

L. Lifeline Terminations

- (1) Each lift line shall be terminated at the powerhead via a standard thimble and a copper oval compression sleeves installed at the factory.
- (2) Lift lines shall be terminated at the load hanger with a low profile Right Angle Cable Adjuster (RACA)[™], thimble and copper oval compression sleeve. The RACA and cable terminations shall be installed at the time of hoist installation.
- (3) The batten trim shall be adjusted up to 6" at the RACA. Systems utilizing turnbuckles or chain to trim the batten shall not be accepted for this installation.

M. Connector Strip - Distribution

- (1) Power to the connector strip shall be fed via UL listed flat cable especially designed and fabricated for this system.
- (2) The flat cable shall be UL listed. The flat cable shall provide one ground and one data cable plus an individual hot and an individual neutral for each of six 120 volt circuits.
- (3) Flat feed wire shall enter a terminal box at the designated end of the raceway. The wiring and all components shall meet UL requirements and NEC codes, as appropriate.

- (4) The connector strip shall be 24 feet long with outlets or pigtails located as specified.
 - (a) Wiring devices shall be fabricated from 16 gauge cold rolled steel. Devices shall be properly cleaned, primed and painted with flat black baked enamel. Circuit numbers shall be 2" high adhesive backed black numbers on yellow background.
 - (b) Eighteen (18) individual pigtails and two (2) 20A duplex receptacle work outlets shall be evenly spaced, on 12" centers in connector strips, or as otherwise specified. Where a circuit would fall on a joint it shall be moved 3" towards the junction box end of the strip. Alternate six (6) dimming circuits for the pigtails.
 - (c) Pigtails shall be three-wire type "SO" rubber jacketed cable sized for the circuit capacity. Connectors are 20A pin type receptacle connectors. Internal wiring shall be sized to circuit capacity and terminated in feed through compression terminals at one end for ease of installation. Wire shall be rated at 125'.
 - (d) Devices except for wall mounted boxes shall be supplied with appropriate hardware for mounting as shown on the Drawings. Connector strips shall have brackets on 5' centers. Wiring devices shall be UL Laboratories Listed.

N. Pipe Batten

- (1) The pipe batten shall be 1½" schedule 40 grade A, seamless pipe fabricated in the largest possible lengths without splices, typically 21'-0" long. Battens of greater length shall be spliced by means of .120 x 1 9/16 dia DOM tube 18" long with 9" of tube inserted into each half of the splice. The tight fitting splice tube shall be held in place by a pair of 3/8 x 2 ½" grade 5 hex bolts on each side of the joint. The bolts shall pass through the pipe at an angle of 90° to each other. There shall be two bolts on each side of the joint spaced 1" and 8" from the joint. Alternatively, one pair of bolts on one side of the joint may be replaced with either plug welds or tight fitting rivets. Pipes shall be straight and painted flat black.
- (2) A safety-yellow batten cap shall be installed at each end of each pipe batten.

O. Power and Control Distribution

- (1) Each hoist shall receive power and control via a pair of 8'-0" long jumper cables extending from the powerhead to the source outlets. The receptacles shall be installed in a sheet metal junction box located less than 8'-0" away from each hoist powerhead and shall include a power and control outlet. Inclusion of a 20 amp 3 phase breaker in the distribution box is optional. The wiring and connectors shall be barriered between high and low voltage. The power/distribution channel shall be UL listed for this application.

P. Control System

- (1) The hoisting system shall be operated by a fixed speed controller. It shall be purpose-designed and fabricated to manage and operate hoist specifically designed for overhead lifting of theatre lights. The system shall incorporate mechanical, electrical and safety features that shall be inherent to this equipment and shall provide an engineered, efficient device to control the equipment. The mechanical, electrical and safety features of this control system shall establish the standard of quality, performance and safety by which hoisting systems of other manufacture shall be evaluated.
- (2) The Control System shall consist of a surface or flush mounted primary control and up to three remote E-stop stations. The hoisting system shall also include one Fixed Speed Remote control device with 35' of flexible cable that may be attached to the system at the primary operating station, the control panel.
- (3) The controller shall include the following features:
 - (a) Key operated power switch; LCD display with feedback/operating information; Key operated hoist load profile training/enable switch; Latching hoist selection buttons with illuminated naming tabs; Rear illuminated hold-to-operate (deadman) up and down operation buttons; Dedicated E-stop button and Outlet for wired remote.
- (4) The controller shall be UL Listed and shall be fabricated from UL Listed components.

Q. Hoist Selection/Operation Buttons

- (1) There shall be illuminated hoist selection buttons. When the button is selected it shall be illuminated. The button shall remain illuminated until it is de-selected.
- (2) When the up or down button is pushed and held the hoist shall move to its next stop location. If the stop location is the adjustable preset, the hoist can be made to continue to travel in the selected direction by releasing and re-pressing the up or down hold-to-operate button until the next stop for the hoist(s) is reached.

R. Key Switches

- (1) A key switch shall control power to the control system. The key must be in the lock and the key turned to the on position for the hoisting system to operate.

S. E-Stop

- (1) The E-stop button on the controller shall be a mushroom button with a illuminated button. The light shall always be on. During normal operation the E-stop button shall be in the out position. An E-stop can be activated via this button by firmly pressing the button in. the button will latch and will immediately cause a class zero stop of all hoists in the system. To continue system operation the E-stop button must be cleared by twisting the button to release the latch.

2.03 Distribution Bill of Materials (ETC part numbers shown)

QTY	DESCRIPTION
1	DRd12-48-120 Dimmer Rack with 24-2 dimmer modules and locking door
1	AUX12X-MCB-3-400 Auxiliary rack with 400A main breaker for 3 phase, 4 watt
1	SS-242P-LPS Smart Switch 24 - 20A double pole relays with Link Power Supply
1	ELTS2-1-D-120-8 Emergency Lighting Transfer System, 8 - 20A circuits
1	Prodigy P1000E Motorized Rigging Set, containing one 24' Connector Strip with 12 twenty amp straight blade receptacle 18" pigtails on 5 circuits, 1 B DMX tap and 2 Cat 6a outlets (Front of House).
Lot	Power and Control Outlet Boxes for motorized rigging sets
1	Control Panel with remote control
Lot	DMX Cable as required

2.04 Pendant Fixture Lowering System

A. General

- (1) Lowering system shall be designed and fabricated for raising and lowing light fixtures weighing up to 250 pounds.
- (2) A self-sustaining worm gear drive arrangement shall prevent free falling of the fixture while lower, raising or servicing.

- (3) The contact suspension unit shall automatically guide fixture up and down through the maze tracking system. It shall support the fixture and consistently return to same position. Locking electrical disconnect switch shall provide power to the fixture and mechanically lock the fixture in place, relieving all tension on cable, gears and motor.
- (4) Electronic control with microchip technology shall provide capability to unlock fixture from contact unit and lower it to pre-determined height. Programmed sequencing shall allow operator to view raising and lowering of fixture.

B. Principal Components of this System

- (1) Electrical disconnect unit assembly. Two electrical contacts plus one ground as standard. (Additional contacts available) and includes fittings for surface mounting to a structure and a flange/stem 3/4" conduit male adapter (3/8" female available).
- (2) Motor Platform Assembly. Formed and painted steel platform, 1/4 HP motor, cable spool/gear box, one change of direction pulley, electrical connection box, and a formed and painted steel cover.
- (3) Cable. 1/8" diameter, 7x19 stranded, galvanized steel aircraft cable assembly. Total cable length required = lower distance + 5ft + horizontal run + vertical run if required. (45ft standard). 40ft Maximum lowering distance.
- (4) Control Panel. An electronic programmable control module with cover plate and connection box.
- (5) Motor. 1/4 HP permanent split capacitor with thermal overload protection. Draws maximum 2.6 amps including control system at 115 VAC 60 HZ. Must be mounted in an accessible location.
- (6) Gearing. Self-sustaining worm gear drive.
- (7) Mounting. The motor platform fits 16" or 24" centers. The assembly is prewired ready to install for standard construction. The disconnect unit can be mounted on platform or mounted on a different structure in non-remote systems.
- (8) Load Capacity. Minimum 20 pounds, maximum 250 pounds.
- (9) Maximum Lowering Distance. 40 feet. Must have 5 extra feet of cable on the drum. Additional cable needed for horizontal distance from winch to the disconnect unit.

- (10) Voltage. 95-135 VAC 60 HZ at 1/4 ampere plus motor current. Only 2.6 motor amps. Lighting fixture requirements must be on separate circuit. Consult electrical contractor.
- (11) Disconnect Unit Electrical Requirements. Maximum 15 amps 277 volt or 20 amp 120 volt per circuit. Fixture load maximum is 2400 watts. Standard unit has four electrical contacts for two circuits.
- (12) System Speed. 1-1/2 feet per minute average.

C. Control for Multiple Lower Systems

- (1) Central control module to allow selected individual operation of lowering up to 8 different pendant fixtures.
- (2) Voltage. Operates on 105-135 V AC 50/60 Hz.
- (3) Output Rating. UL/CSA rating 1 HP @ 120V AC.
- (4) Programmable. Field programmable for raising and lowering times over range of 1 to 1024 sec.
- (5) Switches. Momentary switches to operate module functions. Key lock power on/off switch. Slide switch for 'Teach-Run' functions. Toggle on/off system selection for eight units.
- (6) LED's: Indicates operation in process. Shows system selection as being in 'on' mode.
- (7) Audible Signal. Alerts user that all systems being operated have reached the full 'up' position.
- (8) Emergency Stop. Over rides any function in process to immediately stop all system action.
- (9) Lockout Logic: Protects against accidentally pressing the wrong function button and damaging mechanical system components.
- (10) Cycle Memory. Keeps track of up/down cycle-in-process and restores control to that time in the cycle when the power was last removed for any duration.
- (11) Raise & Lower Memory. Times maintained in EEPROM memory and is not lost during power failures or any time power is removed from the control.

2.05 Dimming and Control System

A. Dimming and Control Systems

- (1) Shall be installed in conduit. Control wiring and conduits though not shown on drawings shall be furnished and installed by the contractor to accomplish the intent of the system as shown on the drawings by symbols and this specification.
- (2) Furnish all equipment, accessories, material and labor required to install and connect in accordance with these specifications and applicable drawings for fully operational Dimming and Control System to the complete satisfaction of the Professional. All material and/or equipment necessary for the proper operation of the system not specified or described herein shall be deemed part of the specifications.
- (3) System shall consist of dimmer rack with solid state dimmers, user interface stations, A/V and contact closure interfaces, control devices as required by the drawings and/or listed herein and complete interconnecting cabling system for a complete and operable Dimming and Control System. Each component of the system shall be listed under the appropriate category by UL and the complete system installation shall conform to the individual component UL listings.
- (4) System manufacturer shall provide check out and start-up of entire system after installation by the Contractor. System manufacturer's technician shall provide up to eight hours of operation and maintenance training for the Owner's selected personnel on the installed system at the Owner's convenience. The training session shall be video and audio recorded by the Contractor and submitted to the Architect with project close-out documents. A pre-recorded factory produced training tape(s) on each component of the supplied system(s) may be substituted.
- (5) Initial programming of system(s) shall be provided by the Contractor per the Architect's direction. Complete operation, maintenance and programming manual(s) shall be provided with the unit.
- (6) Dimmer rack and all control devices shall utilize a DMX protocol for communication such that any device by any manufacturer utilizing this communication protocol can connect to and interface with the System.
- (7) System components shall be the following as manufactured by Lutron or equal in Strand or Electronic Theatre Controls. Quantities shall be as shown on the drawings, listed herein and/or as required for proper system operation per the drawings and this specification. All cabling shall be as recommended by the system manufacturer or exact equal.

<u>Cat. No.</u>	<u>Item</u>	<u>Quantity</u>
C-ESN-SETUP	Energy Saver Node Setup Kit	1
LSC-B2	Standard 2-year warranty with	

	Silver level support plan	1
On-Site Factory	Lutron will provide and on-site	
Startup Visit	technician during startup	1
QSE-CI-NWKE	QS Ethernet & RS232	
	Control interface	1
QSGFP-WH	GRAFIK Eye faceplate kit	2
QSGR-6P	GRAFIK Eye QS (non-RF) 6 zone	2
QSN-2ECO-S	EcoSystem Energi Savr Node with	
	2 EcoSystem Digital Link	1
QSN-4S16-S	Energi Savr Node SoftSwitch	1
QSN-4T16-S	Energi Savr Node 0-10V	
	and Softswitch	1
QWS2-2BRLN-WH	Touch QS Non-Insert 2 Button	
	with Riser/Lower	2

Note: Box sizes and types shown are for estimating purposes only. Actual box sizes and types shall be as recommended by the System manufacturer for the situation encountered.

2.06 Emergency Lighting Transfer System

A. General

- (1) The Emergency Lighting Transfer System (ELTS2) shall provide automatic transfer of branch circuits from normal to emergency power when normal power fails. Each system shall consist of power transfer switches and a control circuitry interconnected to provide complete, automatic protection.
- (2) The ELTS shall transfer designated lighting load branch circuits from dimmers or secondary control outputs to a second power source in the event of a loss of power to the dimmer rack, a normal system failure, or activation of fire alarm.
- (3) The system shall comply with ANSI / UL1008 Transfer Switch Equipment, ANSI / NFPA 110 Standard for Emergency and Standby Power Systems, and ANSI / NFPA 70 (NEC), including Article 700, 701 and 702 safety standards. Emergency transfer systems that do not comply with the below stated NEC articles and sections shall not be permitted
 - (a) Satisfies requirements of the National Electrical Code (NFPA 70):
 - 1) Article 700 – Emergency Systems
 - 2) Article 701 – Legally Required Standby Systems
 - 3) Article 702 – Optional Standby Systems
 - 4) Section 518.3(C) – Assembly Occupancies
 - 5) Section 520.7 – Theatres and Similar Locations

6) Section 540.11(C) – Motion Picture Projection Rooms

- (4) Emergency Transfer equipment shall comply with the US seismic requirements of the International Building Code (IBC) for equipment in the emergency life-safety chain and be approved for seismic applications. Seismic certification shall include installation applications for Roof, Grade, Below Grade, and Intermediate Level installation in the USA with an S_s level of 3.42 and S_{DS} level of 2.28. Emergency transfer equipment that does not meet or exceed the seismic acceptance criteria for non-structural components and systems per the applicable building code or as set forth in the ICC AC-156 shall not be acceptable.
 - (a) The following building codes are addressed under this certification.
 - IBC 2000 – referencing ASCE 7-98 and ICC AC-156
 - IBC 2003 – referencing ASCE 7-02 and ICC AC-156
 - IBC 2006 – referencing ASCE 7-05 and ICC AC-156
 - IBC 2009 – referencing ASCE 7-05 and ICC AC-156
- (5) The ELTS shall be a self-contained system for up to 24 circuits at 20 amps and available for single or three phase power (120/208V, 120/240V or 277/480V). The unit shall be available with either discrete emergency branch circuit feeds from an external circuit breaker panel (by others) or emergency main feed with built-in branch circuit distribution and over current protection.

B. Transfer Switch

- (1) The switch shall be a UL 1008 LISTED, electrically operated and mechanically held (maintained) transfer switch.
- (2) The switch shall be positively locked and unaffected by voltage variations or momentary outages so constant contact pressure is maintained and temperature rise at the contacts is minimized.
- (3) The switch shall be mechanically interlocked to ensure only one of the two possible positions, either Normal or Emergency.
- (4) Each switch shall be configured as guaranteed break-before-make
- (5) Built-in fuses shall provide up to 65000A Short Circuit Current Rating (SCCR) on connected emergency circuits.
- (6) Built-in fuses class G shall be provided on each output for compliance with NEC Section 700.27 Coordination – larger upstream breakers cannot be tripped by downstream branch circuit faults.
- (7) Switch contacts shall withstand transfer without welding, with 180° phase displacement between Normal and Emergency power sources, both sources energized and with 80% load.
- (8) Transfer switch contacts shall be rated for mixed loads, including electric discharge lamps and tungsten filament lamps.

(9) Transfer switches shall be rated for 6000 cycles at full tungsten load.

C. Control Circuit

(1) The control circuitry shall direct the operation of the transfer switch.

(2) User configurable timing delays shall be provided for power transfer between:

(a) loss of normal power and the transfer to emergency up to 10 seconds.

(b) restoration of normal power and the transfer from emergency back to normal power up to 60 seconds.

(3) A normally closed dry contact closure fire alarm input shall be provided.

(4) Transfer switch shall support connections for up to 5 Remote Stations which can manually switch between normal and emergency power.

D. Operation

(1) Transfer to alternate supply will occur when normal supply voltage drops below 80V when used at 120V, or 185V for the A phase and 80V for the B and C phase when used at 277V.

(2) A self-supervising isolated signal input shall be provided for connection to the facility fire alarm. The ELTS2 shall automatically transfer the loads to the Emergency power source when the facility fire alarm is activated as part of a normally-closed loop.

(3) A key-operated switch shall be provided to manually control the ELTS2. All automatic functions shall override this control. Two indicator lights shall be provided to show the position of the transfer switch.

(4) All automatic functions shall override remote control functions. Any combination of open or shorted wiring to remote stations shall not affect automatic functions, or disable the local switch.

E. Enclosure

- (1) The ELTS2 shall be mounted in a NEMA 1 interior or NEMA 4 watertight type enclosure finished in textured epoxy paint. It shall be equipped with a hinged locking door. Material shall be no less than 14 gauge steel.
- (2) An enclosure containing no more than 12 (twelve) 20A circuits shall be 36"H x 24"W x 8.5"D.
- (3) The enclosure shall provide power distribution and branch circuit protection for all emergency power circuits. Systems requiring external emergency power circuit protection shall not be acceptable.
- (4) The enclosure shall be separate and independent of all other equipment. In no instance shall the ELTS2 be enclosed in a dimmer rack or in an enclosure containing other equipment.
- (5) The system shall be provided with an approved overlay mounted on the front of the enclosure, stating, "EMERGENCY LIGHTING TRANSFER SYSTEM".
- (6) The enclosure shall be provided with an approved label indicating that the system is UL1008 LISTED.

PART 3 EXECUTION

3.01 General

- A. Verify that job conditions are ready to receive Work of this Section. Notify Architect of any existing condition which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.
- B. Verify that field measurements are as shown on shop drawings.
- C. Verify that mechanical, electrical, and other items affecting Work of this Section are in place and ready to receive the Work.

3.02 Installation

- A. Install using skilled workmen in accordance with manufacturer's printed instructions and recommendations.
- B. Install Work in accordance highest industry standards. Handle materials to avoid dents and other damages.
- C. Set and secure materials and components rigid, plumb, and square.

3.03 Materials

- a. Contractor shall provide the following and other required items for a complete dimming/control system:

<u>Qty</u>	<u>Description</u>	<u>Luton Model No.</u>
1	120/208V, 3 phase, 4 Wire Main Lugs GP Dimming Panel containing one 20A, 1 pole branch breaker rated at 10,000AIC for each of the 16 dimming circuits. Max input feed = 125A	CGP16-1204ML-20-CGP278
1	RS232 Interface. Used to interface GRAFIK Eye systems with touchscreens or other Intelligent systems. Surface mount.	GRX-CI-RS232
2	See Touch series GRAFIK Eye wallstation. 2-Button Control can be configured to select scenes, toggle partition status, start and stop sequences, initiate a panic function, or fine tune lighting. Insert Version; Optional Backlighting. 1 Gang US Backbox.	SG-2BI-WH-EGN
1	16 Zone GRAFIK Eye 4000 Control Unit with Translucent Top Cover. For use with Lutron GP, LP and XP Power Panels. 4 Gang US Backbox.	GRX-4116-T-WH
4	Zero-ten volt LED control interfaces.	GRX-TVI
1	Nonplenum control cable.	GRX-CBL-46L-500

END OF SECTION

16640 LIGHTING CONTROL SYSTEM

A. GENERAL

1. Interior and exterior lighting circuits/luminaires shall be connect to and controlled by a Programmable Network Lighting Control System, hereinafter referred to as the "System" in this section of the specifications.
2. It is the intent of these plans and specifications to satisfy the requirements of ANSI/AHSRAE/IES Standard 90.1-2010, mandatory Provisions. For bidding purposes, any requirements of the plans/specs that differ from the requirements of ASHRAE 90.1-2010, the Contractor shall follow the requirements of the ASHRAE Standard.
3. Interconnecting wiring (low voltage and line voltage) although not shown on the drawings shall be provided as required for proper operation of the System per the manufacturer's recommendations, the associated drawings and details, and this specification.
4. Provide all equipment, accessories, material and labor required to install and connect in accordance with these specifications and applicable drawings for fully operational System(s) to the complete satisfaction of the Professional. All material and/or equipment necessary for the proper operation of the System(s) not specified or described herein shall be deemed part of the specifications and shall be provided by the Division 16 Contractor
5. Each component of the system shall be listed under the appropriate category(ies) by Underwriters' Laboratories, Inc. (UL) or other approved nationally recognized testing agency and shall be installed and connected per the appropriate listings..
6. The System shall provide time-based, sensor-based (both occupancy & daylight where indicated) and manual lighting control. The System shall provide both manual and automatic on/off control of lighting as indicated and dimming control where indicated. The system shall be capable of automatically configuring itself for default operation without any start-up labor required.
7. All System devices shall be networked together using digital communication and individual device/component addressing. The System architecture shall allow stand-alone zone (room) devices to function in a default capacity should network connectivity be lost. Device setup and control shall be capable of remote operation via a computer connection.
8. For the purpose of this specification a "lighting control zone" shall be defined as the intelligent lighting control devices, the intelligent LED luminaires, the interconnecting communication cabling, the standard luminaires, controlled receptacles and associated line-voltage wiring in a common room or space.
9. Lighting Control System device types and locations are indicated on the drawings to establish the type of coverage, control, etc. required in the associated space. The successful System manufacturer shall provide a complete layout drawing of device locations and mounting heights based on the type of device, coverage ranges, control requirements, room dimensions, aiming etc. as required for proper operation of the System.

10. The successful System manufacturer shall provide device layouts, details, riser diagrams, etc. as required for the proper installation and connection of control and/or communication devices, wiring, etc. as required for proper operation of the System.

11. The system and its devices shall be warrantied for a minimum of 5 years.

B. SYSTEM REQUIREMENTS

1. System architecture shall be based on intelligent lighting control devices, standalone lighting control zones and network backbone communication for remote or time-based operation.

2. Intelligent lighting control devices shall be one or more basic lighting control components: occupancy sensors (ceiling/wall mounted & wall-box), photocell sensors, relay modules, dimming relay modules, manual switch stations and manual dimming stations. Devices shall be rated for the load connected.

3. Where intelligent LED luminaires are specified, lighting control system components shall be capable of having control wiring being directly connected to the associated luminaire(s) for control operation.

4. Lighting control zones shall consist of one or more intelligent lighting control devices, be capable of standalone operation and be capable of being connected to and communicating on a higher level network backbone.

5. Interconnecting communication cabling for intelligent lighting control devices, network devices, intelligent LED luminaires, etc. shall be plenum-rated, low-voltage cabling, to match data cabling specified for this project (Cat 5e min.).

6. A lighting control zone shall be capable of automatically configuring itself for a default operation without any required start-up or set-up labor.

7. Power for devices within a lighting control zone shall come from either a resident relay or dimming device or from the network backbone.

8. All switching, dimming and other control functions shall be accomplished by the devices within the associated lighting control zone unless specifically indicated otherwise (i.e. exterior lighting control, corridor/lobby lighting control, etc.).

9. Individual lighting control zones shall be connected to the network backbone via "bridge" devices that shall function as communication routers for the System and distribute power for connected lighting control zones as required. Each "bridge" device shall contain at least 2 spare ports/zone connections.

10. The System shall have network control "gateway" devices capable of accessing and controlling all connected intelligent devices and linking into an Ethernet LAN.

11. Individual lighting zones shall be capable of being segmented into several "local" channels of occupancy, photocell and switch functionality for more advanced configurations and sequences of operation.
12. System shall be capable of operating a lighting control zone according to several sequences of operation based on a time schedule so as to enable customized time-of-day, day-of-week utilization of the room/space. System shall be capable of controlling artificial lighting in the various lighting control zones in the following methods:
 - a. Auto-On / Auto-Off (via occupancy sensors)
 - b. Manual-On / Auto-Off
 - c. Manual-On to Auto-On/Auto-Off
 - d. Auto-to-Override On
 - e. Manual-to-Override On
 - f. Auto On / Predictive Off
 - g. Multi-Level Operation (multiple lighting levels per manual switch(es))
13. Control software is existing with capability for integration with Building Automation System via BACnet IP.

C. COMPONENTS

1. The Lighting Control System design basis components shall be as manufactured by Lutron or approved equal by Sensor Switch or Hubbell with all required accessories and interconnecting wiring for proper System operation per the manufacturer's recommendation, the drawings and this specification. Systems equal to the design basis system shall be considered.
2. Control Panel - Energy Saver Node with Soft Switch, ESN
3. Communication Sensor Module - QSM Series
4. Power (Relay) Packs - RMJ-5R-DV-B, RMJ-16R-DV-B
5. Dimming (Power) Packs - RMJ-5T-DV-B (0-10V) Dimming
6. Ceiling Occupancy Sensors
 - a. PIR, 360 deg., LRF2-OCR2B-P-WH
 - b. Dual Technology, 360 deg., LOS-CDT Series
7. Wall Occupancy Sensors
 - a. PIR - nWV Series
 - b. Dual Technology - nWV-PDT Series
8. Daylight Sensors - LRF2-DCRB-P-WH
9. Wall Switch/Dimmers - PJ2-2B-GWH-L01/PICO-FP-ADAPT, CW-1-WH, PJ2-2BRLOFWH-L01

D. INSTALLATION

1. Devices and interconnecting cabling shall be installed and connected per the manufacturer's recommendation and good engineering practices.
2. This interconnecting control/communication cabling may be routed without conduit above accessible ceilings with proper conduit sleeves through fire/smoke rated walls. Where inaccessible ceiling types are encountered, communication cabling shall be routed in conduit.
3. All communications cabling shall be pre-fabricated with connectors/jacks and pre-tested. Contractor shall not "field fabricate" communications cabling.
4. System devices shall be installed above the accessible ceiling in the room/space served preferably above one of the entrance doors to the space. Where inaccessible ceiling types are present in the space served, devices shall be mounted above an accessible ceiling in the nearest adjacent space.
5. Wall-box sensors shall be mounted 48" above finished floor to center of the device, as noted on the drawings or at same height as wall switches. Mounting heights may be adjusted slightly to permit cutting of masonry block to the top or bottom of the block course nearest the specified height. All mounting heights shall be consistently cut above or below block coursing such that switches will be the same height above the finished floor.
6. Wall-box sensors shown at door ways shall be mounted adjacent to door ways on opposite side of door from hinges unless prohibited by wall space. Where devices must be mounted on same side of door as hinges, mount so as not to be located behind the opened door. Device shall be mounted within 12" of door frame and/or edge of door.
7. Emergency power packs shall sense loss of power at the normal power panelboard serving the area via a provided sensing circuit and shall automatically switch "ON" the emergency lighting circuit upon loss of normal power regardless of control commands.
8. Dimming power packs and emergency dimming power packs shall have the same switching and control features as standard power packs and emergency power packs and shall provide the control for automatic or manual 0-10V dimming of connected lighting luminaires.
9. Devices located in/on walls or partitions shall be mounted in/on properly sized outlet boxes. A minimum 3/4" conduit shall be routed from each outlet box to above the accessible ceiling in the associated zone or to the next device outlet box where inaccessible ceilings exist.
10. All line voltage wiring shall be routed in conduit per the Division 16/26 specifications. Low-voltage communication wiring may be routed exposed above accessible ceilings when properly supported per EIA/TIA requirements. Where low-voltage wiring crosses ceiling areas open to overhead structure or otherwise visible from below in public spaces, it shall be routed in conduit that is routed tight to the overhead structure.

11. Provide a minimum of 8 hours over 2 days of "hands on" training for Owner by factory rep or approved, qualified manufacturer's representative. Entire system, including software, shall be fully functional and fully tested prior to scheduling training session. System shall be programmed in accordance with Owner's instructions. All O&M manuals shall be available during training.

END OF SECTION

16700 ELECTRICAL POWER CONNECTIONS

A. General

1. Shall be installed in conduit in accordance with SECTION 16110 "RACEWAYS AND FITTINGS".
2. Review architectural drawings and specifications and provide adequate service for and make proper connection to all equipment furnished by General Contractor requiring electrical service.
3. Carefully review plumbing and HVAC drawings and Division 15 of the specifications for mechanical equipment requiring electrical service. Provide adequate service for and make proper connection to all such mechanical equipment requiring electrical service.
4. Electrical connections to equipment shall follow the equipment manufacturer's recommended method. Where equipment furnished exceeds the circuit capacity or requires different characteristics than that shown on the drawings, this information shall be brought to the attention of the Architect, prior to rough-in, or this Contractor shall be responsible for correction.
5. The Division 16 Contractor shall immediately upon notice to proceed and after verification of service with Utility Company, notify in writing the General Contractor and all other affected Contractors the characteristics of the electrical service including voltage and phase. A copy of this notification shall be sent to the Architect.
6. All equipment connections to include a maintenance disconnect of the type indicated or, if not specifically indicated, as recommended by the equipment manufacturer in compliance with the NEC.
7. Where power connections are made out of doors from safety switches and where there is no wall or proper equipment frames to which the switches may be mounted, Contractor shall furnish and install a galvanized angle iron frame independent of the equipment for support of the switches. Frames shall consist of the steel frame sufficient to support all of the switches and a concrete footing not less than 12 inches deep and of sufficient width to assure that 6 inches of concrete surround all of the framing members.
8. On multi-motor equipment connections (i.e. condensing units, roof-top A/C units, etc.), Division 16 Contractor shall verify with Division 15 Contractor and obtain in writing the manufacturer's requirements for equipment overcurrent device. Where fuses or HACR breakers are permitted, furnish HACR rated breaker of size required by manufacturer of equipment. Where fuses only are permitted, furnish fusible disconnect with fuse size required by manufacturer of equipment. Obtain written approval of Division 15 Contractor of overcurrent size before energizing equipment.

B. Instructions

1. Connections by Division 16 Contractor to equipment furnished under Division 15 of the specifications and the mechanical drawings.
 - a. Manual motor switch control and final connections to all ventilating fans. Where fans are furnished with speed controls, the Division 16 Contractor shall mount the control where directed in addition to the manual motor switch. Where fans control or are controlled by other equipment such as timers, motorized louvers, firestats, EMCS control panels, etc., the Division 16 Contractor shall coordinate with the supplying Contractor and make connection to the fan through or with this device as required for proper operation.
 - b. Set disconnect switch near (within 5') or other approved device if disconnect switch not indicated, and make final connection to equipment as required in accordance with SECTION 16110, "RACEWAYS AND FITTINGS". Connections to include power wiring to line voltage control device such as magnetic starter, contactor, etc., and from load side of control device through motor terminals. The control devices shall be furnished by the Division 15 Contractor and installed, where directed, by the Division 16 Contractor. Control devices which are integral pre-wired parts of equipment require connection to line side of control device only by Division 16 Contractor unless otherwise indicated. All additional wiring including control wiring shall be furnished and installed by the Division 15 Contractor. Line voltage thermostats and other temperature control devices regardless of voltage shall be furnished, installed, wired and connected by the Division 15 Contractor.
2. Connections by Division 16 Contractor to equipment furnished under other Divisions of the specifications.
 - a. Set disconnect switch near (within 5') or other approved device, if disconnect switch not shown and make final connection to equipment as required in accord with SECTION 16110 "RACEWAYS AND FITTINGS". Connection to include power wiring to the line side of the equipment controller or to the power connection location as applicable.
 - b. Division 16 Contractor shall obtain approved rough-in drawing for each item of equipment requiring connection and follow manufacturer's recommendation as to location and method of connections. Additional requirements are as follows:

Kitchen equipment: The information shown on the drawings is for estimating use only. The Division 16 Contractor shall be responsible for connecting to the equipment installed with proper service at the correct location shown on the approved kitchen equipment shop drawings. The Division 16 Contractor is responsible for providing electrical work as shown on the electrical drawings and the food service equipment drawings.

Elevators: Requirements for elevators are given in ANSI 17.1. Contractor shall review this code and coordinate all electrical requirements with Elevator Contractor. Power connections/provisions to include elevator motor, controls and sump pump. Division 16 contractor shall provide elevator pit lighting switched where directed by Elevator Contractor and ground fault interrupter type receptacles in elevator pit and equipment room. Elevator control requirements include lobby smoke detectors, hoist-way smoke and heat detectors and equipment room smoke and heat detectors. Interface connections with sprinkler system and auxiliary contact in disconnect switch, where applicable. Provide 3/4" conduit from elevator controller(s) to nearest telephone system backboard.

Computer Equipment: Connection location to be taken from computer equipment drawings if available or architectural drawings. Equipment served from receptacles to have proper NEMA or other configuration receptacle and branch circuit with green equipment ground conductor. All equipment voltages, current, phase and other electrical characteristics shall be verified with computer equipment supplier and each item of equipment shall be properly connected. Computer equipment shall not be energized until connections have been certified and accepted by the proper authority.

System Furniture: Rough-in locations shall be fully coordinated with Architect and furniture manufacturer. Rough-in type shall be as shown on the drawings and shall consist of 3 gang partitioned box with 3 gang raised cover flush in wall or 3 gang floor box with proper cover plate for furniture connection. All power connections from branch circuits to furniture connection whips provided with furniture shall be by the Division 16 Contractor. Proper circuitry shall be provided for the supplied furniture circuit configuration. Voice and data raceways shall be 1" unless shown otherwise on the drawings and shall be provided from box to above accessible ceiling and/or to cable tray (if available) or as shown on the drawings.

- END OF SECTION 16700 -

APPENDIX A

BURNS COOLEY DENNIS, INC.

GEOTECHNICAL AND MATERIALS ENGINEERING CONSULTANTS

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March 31, 2016

Allred Architectural Group
628 Washington Avenue – Suite C
Ocean Springs, Mississippi 39564

Report No. 160092

Attention: Hoppy Allred, AIA, LEED AP

**Geotechnical Investigation
Technology Classroom Building
Alcorn State University
Lorman, Mississippi**

Gentlemen:

Submitted here is the report of our geotechnical investigation for the above-captioned project. This investigation was authorized by Mr. Hoppy Allred's execution of our contract agreement on February 15, 2016 and was generally performed in accordance with our Proposal No. 16001P-17R dated January 29, 2016. Preliminary guideline recommendations pertaining to foundation support of the Technology Classroom building based on the use of rammed aggregate piers for ground improvement have been furnished by Thomas Dunlap, P.E. of our firm in various e-mails sent to Allred Architectural Group and Simkins & Costelli, Inc. We transmitted graphical logs of the exploratory soil borings by e-mail to those firms on March 25, 2016.

We appreciate the opportunity to be of service. If you should have any questions concerning this report, please do not hesitate to call us.

Very truly yours,

BURNS COOLEY DENNIS, INC.

W. David Dennis, P.E.



WDD/khb
Copies Submitted: (2)

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FIGURES

1.0 INTRODUCTION

1.1 Project Description

Plans are being made for the construction of a Technology Classroom building on the campus of Alcorn State University in Lorman, Mississippi. The proposed site for the new classroom building is located across a driveway from and north of the Math and Science building, between the Biotechnology Research Center building and the Facilities Management Department building. The new building will include an L-shaped classroom structure and an auditorium structure. It is our understanding that the building will be three-story with maximum column dead and live loads of 328 kips and 152 kips, respectively. The building will be accompanied by an outdoor amphitheater. The ground surface within the area planned for construction of the new building generally slopes down toward the north between maximum and minimum elevations of approximately 259 ft to 247 ft, respectively. It is our understanding that the finished bottom floor elevation for the building will be 260 ft, and finished outside grades around the building will be near existing ground elevations. Thus, the bottom floor slab at El. 260 ft will be on the order of 1 ft to 13 ft above existing and/or finished outside grades. We understand the preference is to support the bottom floor slab on fill materials placed within the building footprint between the perimeter walls that will serve as retaining walls. Existing ground surface elevations within the proposed construction area for the amphitheater range from about 243 ft to 252 ft. We expect the amphitheater will essentially conform to the existing topography with only minor cutting and/or filling required to achieve planned grades. Most of the construction site is open and clear, with some trees along the western side.

1.2 Purposes

The specific purposes of this investigation were:

- 1) to make exploratory soil borings within the areas planned for construction of the Technology Classroom building and amphitheater;
- 2) to verify field classifications and to evaluate pertinent physical properties of the soils encountered in the borings by means of visual examination of the soil samples in the laboratory and routine tests performed on the samples; and

3) after analysis of the soil boring and laboratory test data, to provide recommendations for site preparation, earthwork construction, and building foundation design and construction, and to also provide guideline recommendations for design and construction of the amphitheater.

2.0 FIELD EXPLORATION

2.1 General

Subsurface soil conditions within the areas planned for construction of the Technology Classroom building and amphitheater were explored by means of 11 borings. The approximate locations of the borings are shown on Figure 1 of this report. Our drill crew located the borings by means of visual sighting and taped measurements from the Facilities Management Department building and Biotechnology Research Center building using distances scaled from the site plan furnished by Allred Architectural Group.

All soils were classified in general accordance with the Unified Soil Classification System. A synopsis of the Unified Soil Classification System is presented on Figure 2 along with symbols and terminology typically utilized on graphical soil boring logs. Graphical logs of the soil borings are presented on Figures 3 through 13. The graphical logs illustrate the types of soil and stratification encountered with depth below the existing ground surface at the individual boring locations. Surface elevations at the top of the graphic boring logs were estimated from ground elevation contours shown on a topographic survey drawing furnished by Allred Architectural Group. Therefore, the surface elevations on the logs should be considered approximate. Approximate latitude and longitude coordinates for the boring locations as determined by our drill crew using a hand-held GPS device are included at the bottom of the graphical logs in the "Comments" section.

2.2 Drilling Methods and Groundwater Observations

Borings 1 through 6, 8 and 9 were made to exploration depths of 29.5 ft, 30 ft, 51.5 ft and 55 ft, and Boring 7 was made to a depth of 80 ft within the planned construction area for the building. Borings 10 and 11 were made to a depth of 19.5 ft within the amphitheater area. Borings 1, 3, 7 and 9 were initially advanced to a depth of 15 ft by dry augering and then were extended to their completion depths of 51.5 ft, 55 ft and 80 ft using rotary wash drilling

procedures. Borings 2, 4, 5, 6, 8, 10 and 11 were advanced full depth by dry augering. Observations were made continuously during auger drilling to detect free water entering the open boreholes. Notes pertaining to groundwater observations are included at the bottom right corner of the graphic boring logs.

2.3 Sampling Methods

Relatively undisturbed samples of the soils encountered in the borings were obtained by pushing a 3-in. OD Shelby tube sampler approximately 1 ft to 2 ft into the soil. The Shelby tube samples were obtained within the depth intervals illustrated as shaded portions of the "Samples" column of the graphic boring logs. Disturbed samples of the soils encountered near and at the bottom of Borings 1 and 7 were obtained by driving a standard 2-in. OD split-spoon sampler 18 in. into the soil with a 140-lb hammer falling freely a distance of 30 in. The depths at which the split-spoon samples were taken are illustrated as crossed rectangular symbols under the "Samples" column of the graphic logs for Borings 1 and 7. Standard penetration test (SPT) blow counts resulting from split-spoon sampling are recorded under the "Blows Per Ft" column of the graphic logs for Boring 1 and 7. For the most part, the Shelby tube and/or split-spoon samples were obtained in the borings at approximate 3-ft to 5-ft intervals of depth. Disturbed auger cutting samples were also obtained in the borings at selected depths during auger drilling. The depths at which the auger cutting samples were taken are illustrated as small I-shaped symbols under the "Samples" column of the graphic boring logs.

2.4 Field Classification, Sample Preservation and Borehole Abandonment

All soils encountered during drilling were examined and classified in the field by a geotechnical engineering technician. Most of the Shelby tube samples were extruded from the sampling tube in the field. Deeper Shelby tube samples of weaker soils were left in the tube for later extrusion in the laboratory. An approximate 6-in. long portion of each field-extruded Shelby tube sample was sealed with melted paraffin in a cylindrical cardboard container to prevent moisture loss and structural disturbance. An additional portion of each field-extruded Shelby tube sample, representative portions of the split-spoon samples, and the auger cutting samples were sealed in jars to provide material for visual examination and testing in the laboratory. Unless other disposition is requested, we routinely discard soil samples after about

six months of storage. In accordance with Mississippi Department of Environmental Quality (MDEQ) regulations, the boreholes for Borings 1 through 9 which exceeded a depth of 25 ft were filled with cement-bentonite grout after completion of drilling and sampling. The boreholes for Borings 10 and 11 were plugged with soil cuttings.

3.0 LABORATORY TESTING

3.1 General

All of the soil samples were examined in the laboratory and tests were performed on the samples to assist in evaluating the strengths, classifications, and volume change properties of the soils encountered. The types of laboratory tests performed are described in the following paragraphs.

3.2 Strength and Moisture/Density Tests

The undrained shear strength characteristics of the fine-grained soils encountered in the borings were investigated by means of two unconfined compression tests and 33 unconsolidated undrained (UU) triaxial compression tests performed on selected undisturbed Shelby tube samples. The results of the unconfined compression tests in terms of cohesion are plotted as small open circles in the data section of the graphic logs for Borings 1 and 6. The cohesions resulting from the UU triaxial compression tests are plotted as small open triangles in the data section of the graphic boring logs. The water content and dry density were also determined for each unconfined and UU triaxial compression test specimen. The water contents are plotted as small shaded circles in the data section of the graphic logs. The dry densities are tabulated to the nearest lb per cu ft under the "Dry Density" column of the logs.

Moisture/density tests were performed on three undisturbed Shelby tube samples from Borings 4, 6 and 8. The water contents and dry densities resulting from those tests are plotted and tabulated on the graphic logs for Borings 4, 6 and 8 in the manner described above for the strength tests.

3.3 Classification Tests

The classifications and volume change properties of the fine-grained soils encountered in the borings were investigated by means of 12 sets of Atterberg liquid and plastic limit tests. The results of the liquid and plastic limit tests are plotted as small crosses interconnected by dashed lines in the data section of the graphic boring logs. In accordance with the Unified Soil Classification System, fine-grained soils are classified as either clays or silts of low or high plasticity based on the results of Atterberg limit tests. The numerical difference between the liquid limit and plastic limit is defined as the plasticity index (PI). The magnitudes of the liquid limit and plasticity index and the proximity of the natural water content to the plastic limit are indicators of the potential for a fine-grained soil to shrink or swell upon changes in moisture content or to consolidate under loading. The proximity of the natural water content to the plastic limit is also an indicator of soil strength.

The classifications of fine-grained soils containing sand were investigated by means of two minus No. 200 sieve tests performed on samples taken near or at the bottom of Borings 1 and 7. The percentages of fines resulting from those tests are tabulated under the "% Passing No. 200 Sieve" column of the graphic logs for Borings 1 and 7.

3.4 Consolidation Tests

The compressibility characteristics of the fine-grained soils encountered in the borings were investigated by means of four consolidation tests performed on selected undisturbed Shelby tube samples from Borings 5, 9 and 10. Specimens trimmed from the samples were placed in oedometers, inundated, consolidated under eight increasing load increments, and rebounded under three load decrements. The results of the consolidation tests are presented graphically on Figures 14 through 17 as semi-log plots of void ratio versus applied pressure. Also tabulated on Figures 14 through 17 are the moisture contents, dry densities, and Atterberg limits for the four samples tested. The water contents and dry densities are also plotted and tabulated at the appropriate depths on the graphic logs for Borings 5, 9 and 10.

3.5 Water Content Tests

Water content tests were performed on 118 samples to assist in corroborating field classifications and to extend the usefulness of the strength, plasticity, consolidation, and field

SPT blow count data. The results of the water content tests are plotted as small shaded circles in the data section of the graphic boring logs. The water content data have been interconnected on the logs to illustrate a continuous profile with depth.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 General

A general description of subsurface soil and groundwater conditions revealed by the borings is provided in the following paragraphs. The graphical logs of the borings shown on Figures 3 through 13 should be referred to for specific soil and groundwater conditions encountered at each boring location. Stick logs of the borings are shown in profile on Figure 18 to aid in visualizing subsurface soil conditions. Tabulated adjacent to the stick logs are liquid and plastic limits, water contents, dry densities, cohesions, SPT blow counts, and percentages of fines.

4.2 Nature of Loessial Soils

The soils encountered in the borings to depths of about 53.5 ft to 54 ft appear to be fairly typical of loessial soils which are normally encountered along the eastern bluff of the Mississippi River valley. The loessial soils are wind deposited and consist predominantly of silt size quartz and feldspar particles and secondarily of clays. The natural loessial soils exhibit some cementation which is attributed to capillary action between the silt-size particles and the clay particles, and also by calcite. The strength and compressibility of loessial soils are highly dependent upon moisture content. At lower moisture contents, the loessial soils are generally moderately strong and have a low compressibility potential. As the water content increases, the clay particles lose their ability to bind the silt grains together, and consequently the loessial soils become weak and compressible at relatively high moisture contents. Loessial soils have a relatively high vertical permeability due to the presence of tiny vertically oriented root tubules and are fairly susceptible to percolation of surface water resulting from rain. The moisture contents of loessial silts will increase during wet seasons, and a perched water table can exist in areas where the loessial soils are underlain by another formation having a relatively low permeability which blocks the downward percolation of water through the loess. The water contents of the loessial soils near the surface can increase during

periods of prolonged and heavy rainfall. The water contents of the deeper loessial soils can increase as the result of a rise in the perched groundwater level. Increased moisture contents resulting from either rainfall or a rising water table can reduce the strength of the loessial soils considerably. Because of the loss in strength of the loess when it becomes saturated and also because of the fact that the loess soils contain a predominant percentage of silt sizes, they are very susceptible to surface and subsurface erosion. Subsurface erosion occurs as surface water moves along a root hole or other void at the top of a slope and exits along the side of the slope.

The generalized loessial stratification at the site consists of silty clays (CL) directly beneath the ground surface underlain, in turn, by clayey silts (ML) and silts (ML). The stratification encountered is related to the physical properties of the loessial soils and also to weathering. The plasticity of the loess generally decreases with depth below the surface until it becomes nonplastic. The higher plasticity of the near-surface loessial soils and the decrease in plasticity with depth are related to the weathering process. Weathering causes a breakdown of the feldspar grains into clays which results in classifications of slightly silty clay (CH) or silty clay (CL) for the weathered loess. Therefore, the more plastic loessial soils are typically encountered near the ground surface because the surficial soils are subjected to a greater degree of weathering.

4.3 Soil Stratification

The ground surface at the boring locations was found to be directly underlain by loessial silty clays (CL). The silty clays (CL) were generally encountered to depths ranging from about 5 ft to 8 ft below the surface. However, at the location of Boring 5, the silty clays (CL) were found to extend to a depth of about 11 ft below the surface. For the most part, the silty clays (CL) are classified as stiff, very stiff and hard with respect to consistency. Medium stiff silty clays (CL) were encountered only at the location of Boring 5 between depths of approximately 4 ft and 7 ft. Unconfined compression and UU triaxial compression tests performed on undisturbed samples of the stiff, very stiff and hard silty clays (CL) yielded cohesions ranging from 1.12 to 6.19 kips per sq ft. The stiff silty clays (CL) are considered to have moderate strength and moderate compressibility. The very stiff and hard silty clays (CL) are considered to have high strength and low compressibility. A UU triaxial compression test performed on an undisturbed sample of the medium stiff silty clays (CL) that were encountered between approximate depths of 4 ft and 7 ft at Boring 5 yielded a cohesion of 0.99 kips per sq ft. The medium stiff silty clays (CL) are

considered to have low to moderate strength and moderate to high compressibility. Atterberg limit tests performed on five representative samples of the loessial silty clays (CL) yielded liquid limits ranging from 36 to 50, plastic limits that vary between 20 and 25, and plasticity indices that range from 15 to 26. The silty clays (CL) are considered to have low shrink/swell potential.

The loessial silty clays (CL) were found to be underlain by loessial clayey silts (ML) and silts (ML). Loessial clayey silts (L) were encountered within limited depth intervals at the locations of Borings 1, 4, 5, 6, 7 and 8, and typically right below the silty clays (CL). Loessial silts (ML) were encountered to the 19.5-ft, 29.5-ft and 30-ft termination depths of Borings 2, 4, 5, 6, 8, 10 and 11. Loessial silts (ML) were also encountered to the 51.5-ft termination depth of Boring 1. Loessial silts (ML) were encountered to an approximate depth of 54 ft below the surface at the locations of Borings 3 and 7, and to a depth of about 53.5 ft at the location of Boring 9. In general, the loessial clayey silts (ML) and silts (ML) have moisture contents below 30 percent and are characterized as medium dense and dense to depths ranging from approximately 18 ft to 28 ft below the surface. UU triaxial compression tests performed on undisturbed samples of the medium dense and dense clayey silts (ML) and silts (ML) yielded cohesions ranging from 0.99 to 5.00 kips per sq ft. The medium dense and dense clayey silts (ML) and silts (ML) are considered to have moderate to high strength and low compressibility. At depths greater than about 18 ft to 28 ft, water contents within the loessial silts (ML) are generally greater than 30 percent and they are characterized as loose. UU triaxial compression tests performed on undisturbed samples of the loose silts (ML) yielded cohesions ranging from 0.14 to 0.46 kips per sq ft. The loose silts (ML) are considered to have low strength and moderate compressibility. Dry densities within the loessial clayey silts (ML) and silts (ML), whether loose, medium dense or dense, were found to range from 83 to 99 lbs per cu ft. Atterberg limit tests performed on four representative samples of the loessial silts (ML) yielded liquid limits ranging from 27 to 32, plastic limits that vary between 24 and 27, and plasticity indices that range from 1 to 5. The loessial silts (ML) were found to be slightly clayey within some depth intervals. The loessial clayey silts (ML) and silts (ML) are nonexpansive.

The loessial silts (ML) were found at the locations of Borings 3, 7 and 9 to be underlain at depths of approximately 53.5 ft and 54 ft by fine-grained soils that appear to be Catahoula formation deposits. The Catahoula soils that were encountered to the 55-ft termination depth of Borings 3 and 9 consist of silty clays (CL). Catahoula formation silty clays (CL) were also

encountered at Boring 7 within the approximate depth intervals of 54 ft to 58 ft and 68 ft to 73.5 ft. The Catahoula silty clays (CL) are classified as stiff and very stiff with respect to consistency and are considered to have moderate to high strength and moderate to low compressibility. UU triaxial compression tests performed on two representative samples of the stiff and very stiff Catahoula silty clays (CL) yielded cohesions of 1.04 and 2.53 kips per sq ft. Atterberg limit tests performed on two representative samples of the Catahoula silty clays (CL) produced liquid limits of 32 and 34, plastic limits of 20 and 21, and plasticity indices of 12 and 13. The Catahoula silty clays (CL) are considered to have low shrink/swell potential.

Catahoula formation clays (CH) were encountered at the location of Boring 7 within the approximate depth interval of 58 ft to 68 ft and from a depth of about 78 ft to the 80-ft termination depth of that boring. The Catahoula clays (CH) are classified as very stiff and hard and are considered to have high strength and low compressibility. A UU triaxial compression test performed on an undisturbed sample of the hard Catahoula clays (CH) yielded a cohesion of 4.34 kips per sq ft. Atterberg limit tests performed on a representative sample of the Catahoula clays (CH) produced a liquid limit of 62, a plastic limit of 16, and a plasticity index of 46. The Catahoula clays (CH) are considered to be highly expansive.

The remaining Catahoula formation soils encountered at Boring 7 consist of sandy silts (ML) which were found to lie between approximate depths of 73.5 ft and 78 ft. The sandy silts (ML) are characterized as dense based on an SPT blow count of 44. The sandy silts (ML) are nonexpansive and are considered to have high strength and low compressibility.

4.4 Groundwater

Free water was not encountered during auger drilling for the borings. Even though free water was not encountered while auger drilling, the loose silts (ML) which have water contents exceeding 30 percent and lie below depths on the order of 18 ft to 28 ft are saturated, and in our opinion, that is indicative of a groundwater table within the loose silts (ML). Groundwater conditions at the site will be influenced by rainfall, surface drainage, and by the rise and fall of water levels in any nearby ditches, creeks, ponds or other bodies of water. Groundwater conditions at the site can also be influenced by man-made changes. Surficial soils can become saturated and weak to relatively shallow depths during periods of prolonged and heavy rainfall.

5.0 DISCUSSION

5.1 General Soil Conditions

Subsurface soils encountered within the 80-ft maximum exploration depth of the borings made for this investigation generally consist of loessial soils underlain by Catahoula formation deposits. Loessial silty clays (CL) were encountered immediately below the ground surface at all 11 boring locations. The silty clays (CL) were found to extend to approximate depths of 5 ft to 8 ft below the surface at the locations of Borings 1 through 4 and 6 through 11, and to a depth of about 11 ft below the surface at the location of Boring 5. For the most part, the silty clays (CL) are classified as stiff, very stiff and hard with respect to consistency and are considered to have moderate to high strength and moderate to low compressibility. Medium stiff silty clays (CL) that are considered to have low to moderate strength and moderate to high compressibility were encountered at Boring 5 within the approximate depth interval of 4 ft to 7 ft. The silty clays (CL) are considered to have low shrink/swell potential.

Loessial clayey silts (ML) and silts (ML) were encountered below the loessial silty clays (CL). The loessial clayey silts (ML) were encountered within limited depth intervals at the locations of Borings 1, 4, 5, 6, 7 and 8, and typically right below the silty clays (CL). Loessial silts (ML) were encountered to the termination depths of Borings 1, 2, 4, 5, 6, 8, 10 and 11, and to depths of approximately 53.5 ft and 54 ft at the locations of Borings 3, 7 and 9. In general, the loessial clayey silts (ML) and silts (ML) to depths ranging from about 18 ft to 28 ft below the surface are characterized as medium dense and dense and are considered to have moderate to high strength and low compressibility. The loessial silts (ML) that lie below depths on the order of 18 ft to 28 ft generally have water contents greater than 30 percent and are characterized as loose. The loose silts (ML) are considered to have low strength and moderate compressibility. The loessial clayey silts (ML) and silts (ML) are nonexpansive.

Catahoula formation soils were encountered below depths of about 53.5 ft and 54 ft at the locations of Borings 3, 7 and 9. The Catahoula formation soils include stiff to very stiff silty clays (CL), very stiff to hard clays (CH), and dense sandy silts (ML). For the most part, the Catahoula formation soils are considered to have high strength and low compressibility. The Catahoula silty clays (CL) are considered to have low shrink/swell potential, and the Catahoula

sandy silts (ML) are nonexpansive. The Catahoula clays (CH) are considered to be highly expansive.

Free water was not encountered during auger drilling for the borings; however, the loessial silts (ML) with water contents greater than 30 percent which are characterized as loose and lie below depths on the order of 18 ft to 28 ft are saturated, and in our opinion, that is indicative of a groundwater table within the loose silts (ML).

5.2 Geotechnical-Related Design Considerations

From a geotechnical standpoint, the primary factors relevant to foundation design and construction for the Technology Classroom building are bearing capacity and settlement due to soil consolidation/compression under fill and structural loading. We understand that the building will be a three-story structure with maximum column dead and live loads of 328 kips and 152 kips, respectively. Thus, the total maximum column load is 480 kips. For that column loading, the building is considered to be a heavily loaded structure. Considering bearing capacity and settlement issues, it is our opinion that the heavily loaded Technology Classroom building should be supported by either a deep pile foundation or spread footings in conjunction with ground modification by means of rammed aggregate piers to reduce settlement and increase bearing capacity. It is our understanding that the nearby Biotechnology Research Center building is supported on spread footings in conjunction with ground modification by means of rammed aggregate piers, and that approach is preferable for foundation support of the Technology Classroom building. Therefore, recommendations are provided subsequently in this report for a spread footing foundation with ground modification by means of rammed aggregate piers for support of the Technology Classroom building. The rammed aggregate pier ground modification system should be designed by a specialty foundation company. The design calculations should demonstrate that the rammed aggregate pier soil reinforcement will control long-term settlement within tolerance limits. If long-term settlements predicted by the specialty foundation company are excessive for the spread footing foundation in conjunction with ground modification by means of rammed aggregate piers, then a deep pile foundation should be considered for support of the building.

It is our understanding that the finished bottom floor elevation for the building will be 260 ft, and finished outside grades around the building will be near existing ground elevations.

The bottom floor slab at El. 260 ft will be on the order of 1 ft to 13 ft above existing and/or finished outside grades. We understand the preference is to support the bottom floor slab on fill materials placed within the building footprint between the perimeter walls that will serve as retaining walls. An analysis was conducted to estimate the total settlement that could potentially occur within the area of the building where approximately 13 ft of fill materials will be placed to achieve the planned bottom floor elevation. The soil stratification revealed by the borings and the consolidation test data were utilized in the settlement analysis. Based on the analysis, at locations within the interior of the building where the fill thickness will be as great as 13 ft, the estimated total settlement is on the order of 4 in. Of course, less settlement will occur in the vicinity of the perimeter walls of the building and at locations where the fill thickness is not as great as 13 ft. Consolidation of the loessial silty clays (CL), clayey silts (ML) and silts (ML) will occur fairly rapidly, and in our opinion, at least 50 percent of the settlement will occur during fill placement. Thus, on the order of 1 in. to 2 in. of settlement could still occur after fill materials have been placed to grade within areas of the interior of the building where the fill thickness is as great as 13 ft. It should be noted that the bottom floor slab within those areas could experience that magnitude of settlement if it is cast very soon after fill materials are placed to grade. In order to minimize total and differential settlements within the bottom floor slab, we would recommend that the slab not be cast until at least 30 days have elapsed after fill materials are placed to grade. If that is not allowed by the construction schedule or if some settlement of the floor slab is not permitted, then the bottom floor slab should be structurally supported above grade on the spread footing and rammed aggregate pier foundation system.

Details of our recommendations for site preparation, earthwork construction, and design and construction of the spread footing and rammed aggregate pier foundation system are included in the following subsections of this report. Guideline recommendations are also provided for design and construction of the amphitheater.

6.0 RECOMMENDATIONS

6.1 Site Preparation and Earthwork Construction

6.1.1 Site Preparation. The proposed construction site for the Technology Classroom building is generally situated on grass-covered sloping terrain with some trees along

the western side. Any trees located within the area to be occupied by the building should be removed, including stumps and root systems. Additionally, any existing pavements, building foundations, and underground utilities should be removed. Stripping should then be conducted to a sufficient depth to remove any other subsurface obstructions, all noticeably weak and organic-laden surficial soils, vegetation, debris, brush and roots. Excavation should be performed to remove weak soils within the building area, such as the medium stiff silty clays (CL) as encountered within the approximate depth interval of 4 ft to 7 ft at the location of Boring 5. The lateral and vertical extent of excavation required to remove weak soils must be determined in the field during earthwork construction. Excavation of weak soils should extend laterally not less than 7 ft beyond the perimeter of the building. It should be noted that the on-site loessial silty clays (CL), clayey silts (ML) and silts (ML) exposed after stripping and excavation are very susceptible to pumping under wet conditions because of their sensitive nature. The actual condition of these soils at the time of construction will be strongly influenced by the season of the year and the rainfall conditions preceding and during construction. Therefore, it would be preferable to perform construction during a relatively dry season of the year.

Large variations in fill thickness over short distances contribute to excessive differential settlement. Of particular concern are areas where, over a short distance, the subgrade varies from undisturbed soil to a significant thickness of fill. This condition could possibly occur within the limits of the Technology Classroom building. If this condition occurs, we recommend that some excavation be performed to create a less abrupt transition from cut to fill and a more gradual increase in fill thickness within the building pad.

Prior to the placement of any fill materials, the soils exposed after stripping and excavation should be scarified to a minimum depth of 6 in. and compacted to not less than 95 percent of standard Proctor maximum dry density (ASTM D 698) with stability present. Alternatively, the exposed soils could be proofrolled with loaded dump trucks to demonstrate stability. Stability is defined as the absence of significant pumping, rutting or yielding of soils during compaction or proofrolling. If stability is not evident in some areas, either additional excavation, drying by processing, treatment of the in situ soils with an admixture, or a combination of these approaches, might be required to achieve stable conditions.

The effort required to mitigate unstable soils will be influenced by the season of the year when earthwork is performed. At the time of our field exploration, the subsurface soils

encountered at the boring locations were generally found to have water contents higher than the optimum moisture content, thus, they will most likely pump when exposed after stripping and excavation. The subsurface soils would likely be dryer during the hot late summer and could weaken during heavy rainfall events. We recommend that earthwork be performed during a dry summer or fall season, if the schedule permits. It should be recognized that soils which are demonstrated to be adequately stable during stripping, excavation, scarification/compaction and/or proofrolling can become unstable if they are disturbed by construction traffic or if they are exposed to rainfall prior to filling.

The on-site loessial silty clays (CL), clayey silts (ML) and silts (ML) are very susceptible to pumping when wet. The construction techniques, types of equipment utilized and site drainage provided during construction will have a great effect on the performance of the loessial soils. The routing of heavy, rubber-tired equipment should be controlled to minimize, as much as possible, traffic in the construction areas. All traffic should be discouraged during periods of inclement weather. It should be noted that soils which initially demonstrate adequate stability can become unstable if they are disturbed by construction traffic. If pumping is initiated in the loessial silty clays (CL), clayey silts (ML) and silts (ML), as a construction expedient the pumping can be counteracted by treating these materials with hydrated lime. It is estimated that about 4 to 6 percent hydrated lime by dry weight of soil could be required.

6.1.2 Fill Placement and Compaction. The on-site loessial silty clays (CL), clayey silts (ML) and silts (ML) removed for required excavation can be utilized as compacted fill materials. Off-site loessial silty clays (CL), clayey silts (ML) and silts (ML) can also be imported for use in accomplishing earthwork construction requirements. It should be realized that stringent moisture control will be required during compaction of the loessial clayey silts (ML) and silts (ML), because these soils are very susceptible to pumping at water contents above the optimum moisture content. For this reason, it would be preferable to utilize the silty clays (CL) which have some plasticity and are less susceptible to pumping. Also, the silty clays (CL) are much less erodible than the clayey silts (ML) and silts (ML). Other imported soils considered to be suitable for select fill are sandy clays (CL) and clayey sands (SC) having a plasticity index within the range of 7 to 25 and a liquid limit less than 45. All fill soils should be free of organic matter, debris and any other deleterious material. The fill materials placed within the limits of

the building should be compacted from lifts not exceeding 9 in. in loose thickness to not less than 98 percent of standard Proctor maximum dry density (ASTM D 698). Fill soils placed outside the limits of the building should be compacted to not less than 95 percent of standard Proctor maximum dry density. Except for clayey silts (ML) and silts (ML), the fill materials should be placed at moisture contents within 3 percentage points of the optimum water content. Clayey silts (ML) and silts (ML) will require a more strict moisture control of within 2 percentage points of the optimum water content during placement. Stability must be evident during compaction of each lift before any subsequent lifts of fill material are added.

Laboratory classification tests, including Atterberg limit determinations and grain-size analyses, should be performed on the fill soils initially and routinely during earthwork operations to check for compliance with the recommendations provided herein. Field moisture/density tests should be performed frequently in the scarified and compacted on-site soils and in each compacted lift of fill material to assist in evaluating whether the recommended moisture contents and dry densities are being achieved. As a guide, for building earthwork construction we suggest a minimum of one test per lift for each 2,500 sq ft of surface area or portion thereof.

Finished site grades should be sloped to promote quick runoff of storm water and provide positive drainage away from the building. Fill materials should extend laterally not less than 6 ft beyond the perimeter of the building and then slope down to natural ground at an inclination not steeper than 3H:1V. As indicated previously in the report, loessial clayey silts (ML) and silts (ML) are very susceptible to erosion. Erosion protection should be provided for the short-term and long-term. The establishment and maintenance of adequate grass cover is essential for long-term erosion control.

6.2 Spread Footing Foundation and Rammed Aggregate Piers

The Technology Classroom building could be supported by spread footings accompanied by ground improvement beneath the footing locations for support of building columns and walls. Rammed aggregate pier soil improvement elements could be used beneath the footing locations for that purpose. This system consists of relatively shallow, crushed-stone-filled holes spaced in a pattern that reinforce the subsurface soils and therefore increase bearing capacity and minimize settlement. The soil improvement elements are usually constructed by drilling a 30-in. diameter hole, removing a volume of soil, and building a bottom bulb of clean, open-graded stone. Installation of the rammed aggregate piers might require the use of temporary casing within the

relatively weak soils revealed by the borings made for this investigation. The rammed aggregate pier shaft is built on top of the bottom bulb using well-graded base course stone placed in 12-in. lifts. The result of rammed aggregate pier installation is a reinforced zone of soil directly beneath the footings that allows the use of spread footings sized for a relatively high bearing pressure. The rammed aggregate piers would likely result in a soil improvement yielding an allowable bearing pressure in the range of about 4,000 to 6,000 lbs per sq ft with acceptable settlement. The rammed aggregate pier foundation system and should be designed by a specialty foundation company and constructed by a licensed installer. The designer should provide detailed design calculations sealed by a professional engineer licensed to practice in the State of Mississippi. The design calculations should demonstrate that the soil reinforcement will control long-term settlement. We recommend that footings to support the building columns and walls bear not less than 2 ft below finished grade. A greater bearing depth may be required to resist uplift forces, or alternatively the rammed aggregate piers themselves could possibly be utilized to aid in resisting uplift.

The bottom floor slab of the building may be supported on grade, provided the slab is lightly loaded, site preparation and earthwork construction are performed as recommended, and the potential settlements described previously in the report are acceptable. The floor slab should be adequately reinforced for anticipated loading conditions and deflections and to minimize slab cracking. At the structural engineer's discretion, the floor slab may be additionally stiffened by means of reinforced concrete grade beams or ribs.

6.3 Perimeter Building Wall Pressures

As indicated previously in the report, the preference is to support the bottom floor slab of the Technology Classroom building on fill materials placed within the building footprint between the perimeter walls that will serve as retaining walls. The perimeter building walls must be designed for lateral earth and water pressures. Backfill soils placed against the walls should consist of loessial silty clays (CL), clayey silts (ML) and silts (ML), or sandy clays (CL) and clayey sands (SC) as described in subsection **6.1 Site Preparation and Earthwork Construction**. To facilitate drainage and minimize the development of water pressures acting on the walls, we recommend the inclusion of some form of drainage system between the backfill and walls. The drainage system could consist of a coarse, open-graded aggregate separated from the backfill by a nonwoven geotextile. Alternatively, a geocomposite drain, such as Tensar DC

1100, could be utilized for this purpose. The geocomposite drain basically consists of a thin polymeric core placed against the wall and separated from the backfill soil by a nonwoven geotextile. We recommend that the drainage system utilized between the backfill and walls be connected with a perforated PVC collector pipe placed adjacent to the walls at a point near the base of the walls. The pipe should also be separated from the backfill soils by the geotextile of the drainage system. The collector pipe should be sloped to drain by gravity to some point downhill from the building, or alternatively, the collector pipe should be sloped to drain to a sump including a pump that will remove the collected water. As an additional precaution to prevent or minimize seepage of water through the perimeter building walls, the inside surface of the walls could be coated with a commercially available waterproofing agent. Alternatively, a geomembrane separating the walls from the backfill and drainage system materials could be utilized. We do not recommend the use of visquene for this purpose.

In our opinion, the perimeter walls of the building will be relatively nonyielding and should be designed for at-rest earth pressure conditions. For clayey silt (ML) and silt (ML) backfill materials, we recommend that an equivalent fluid unit weight of 60 lbs per cu ft be utilized for unsubmerged conditions to develop a triangular at-rest earth pressure distribution for wall analysis and design. Below the anticipated water level in the backfill consisting of clayey silts (ML) and silts (ML), an equivalent fluid unit weight of 90 lbs per cu ft should be utilized to compute the combined at-rest earth and water pressures acting on the walls. For silty clays (CL), sandy clays (CL) and/or clayey sands (SC) utilized as backfill, we recommend that an equivalent fluid unit weight of 80 lbs per cu ft be utilized for unsubmerged conditions to develop a triangular at-rest earth pressure distribution for wall analysis and design. Below the anticipated water level in the backfill consisting of silty clays (CL), sandy clays (CL) and/or clayey sands (SC), an equivalent fluid unit weight of 100 lbs per cu ft should be utilized to compute the combined at-rest earth and water pressures acting on the walls. In addition to the triangular earth pressure distribution, lateral uniform pressures will be imposed on the walls by the weight of the floor slab and any surcharge loads acting on the backfill surface immediately adjacent to the walls. For wall design, we recommend that the additional lateral uniform pressure be computed as a percentage of the vertical uniform stress imposed by the floor slab and surcharge loads. For clayey silt (ML) and silt (ML) backfill, the additional lateral uniform pressure should be computed as 50 percent of the vertical stress for at-rest conditions. For silty clay (CL), sandy

clay (CL) and/or clayey sand (SC) backfill, the additional lateral uniform pressure should be computed as 70 percent of the vertical stress for at-rest conditions.

We recommend that wall backfill materials be compacted as previously described in subsection **6.1 Site Preparation and Earth Work Construction**. To avoid inducing excessive lateral pressures upon the walls during compaction, we recommend that motorized compaction equipment such as rollers or vibratory compactors be operated no closer than 3 ft from the walls. In the 3-ft wide zone immediately adjacent to the walls, we recommend compaction of the backfill in maximum 5-in. thick loose lifts utilizing hand-operated mechanical tampers. Stability must be evident during compaction of each lift before any subsequent lifts of backfill material are added. Stability is defined as the absence of significant pumping, rutting or yielding of soils during compaction. Field moisture/density tests should be performed frequently in each compacted lift to assist in evaluating whether recommended moisture contents and dry densities are being achieved

6.4 Amphitheater

We are not aware of the structural features of the amphitheater, but we expect it will essentially consist of a reinforced concrete slab cast on a sloping grade. Earthwork construction within the area of the amphitheater should be performed in accordance with the recommendations included in subsection **6.1 Site Preparation and Earthwork Construction**. The slab should be reinforced for anticipated loading conditions and deflections and to minimize slab cracking. Grade beams cast monolithically with the slab could be utilized at the discretion of the structural engineer to provide rigidity or to anchor the slab to the slope. Grade beams required to support any loading should be proportioned for critical combinations of dead, live and wind loads utilizing a net allowable soil bearing pressure of 1,500 lbs per sq ft. We recommend a minimum base width of 12 in. for load-bearing grade beams. The grade beams should be reinforced for both positive and negative bending.

6.5 Other Design and Construction Considerations

We recommend that foundation excavations be left open for the shortest possible duration to minimize exposure of the bearing soils to rainfall. Drainage should be maintained away from foundation excavations during construction. Soils exposed in the bottom of foundation

excavations should be observed prior to concrete placement. If these materials are found to be weak or loose, overexcavation and backfilling will be required to provide strong soils immediately beneath foundation elements.

If flower and shrub beds including sprinkler systems are placed adjacent to the Technology Classroom building, the beds should be prepared such that they do not trap water, and sprinklers should be operated only enough to satisfy the water demands of the plants and shrubs. Excessive watering and ponding within the flower and shrub beds could result in downward percolation of water into the underlying foundation soils causing them to lose strength. Rainwater falling on the roof of the building should be collected and prevented from reaching the ground immediately adjacent to the building. Downspouts extending from the roof should be equipped with extensions at ground level that are sloped to emit collected rainwater not less than 6 ft away from the building. The downspouts could be connected to solid discharge pipes buried beneath the ground. We caution that these pipes should be flexible enough to accommodate some differential movement and all pipe connections must be leak free.

Trees remove water from the ground by transpiration causing vertical and horizontal shrinkage of fine-grained soils. To minimize these effects, we recommend that any trees planted for landscaping purposes be located at least one-half their anticipated mature height away from the building. If the risk of more movement is acceptable, a less strict building-to-tree spacing of about 25 ft for hardwoods and 15 ft for pines could be utilized.

Final grades around the building should provide rapid and effective drainage of rainwater and downspout water away from the building, with no areas allowed for water to pond. Underground sources of water such as leaking water lines, sewer lines, etc., should be prevented as much as possible in the initial construction, and any leaks that develop should be promptly repaired.

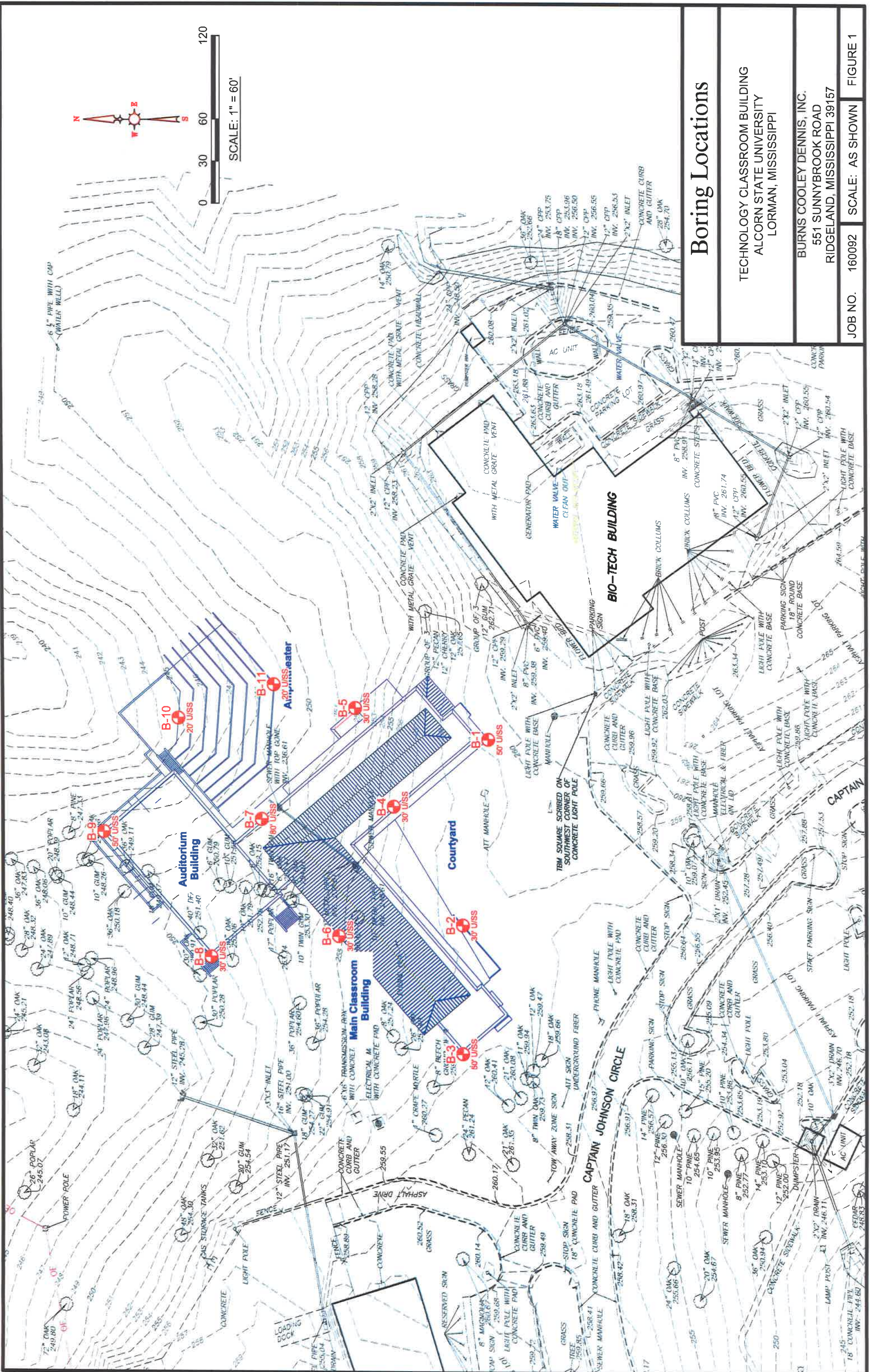
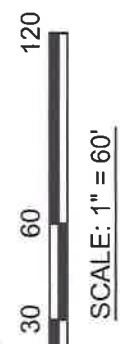
The site for the Technology Classroom building on the campus of Alcorn State University in Lorman, Mississippi lies within a relatively low seismic activity region according to the seismic zone mapping referenced in the International Building Code. Given the site soil profile as revealed by the borings and anticipated for the area based on our experience, a site class D should be used in a seismic load evaluation.

7.0 REPORT LIMITATIONS

The analyses, conclusions, and recommendations discussed in this report are based on conditions as they existed at the time of our field investigation and further on the assumption that the exploratory borings are representative of subsurface conditions throughout the area investigated. It should be noted that actual subsurface conditions between and beyond the borings might differ from those encountered at the boring locations. If subsurface conditions are encountered during construction that vary from those discussed in this report, Burns Cooley Dennis, Inc. should be notified immediately in order that we may evaluate the effects, if any, on earthwork and foundation design and construction.

Burns Cooley Dennis, Inc. should be retained for a general review of final design drawings and specifications. It is advised that we be retained to observe earthwork and foundation construction for the project in order to help confirm that our recommendations are valid or to modify them accordingly. Burns Cooley Dennis, Inc. cannot assume responsibility or liability for the adequacy of recommendations if we do not observe construction.

This report has been prepared for the exclusive use of Allred Architectural Group for specific application to the geotechnical-related aspects of design and construction for the new Technology Classroom building to be constructed on the campus of Alcorn State University in Lorman, Mississippi. The only warranty made by us in connection with the services provided is we have used that degree of care and skill ordinarily exercised under similar conditions by reputable members of our profession practicing in the same or similar locality. No other warranty, express or implied, is made or intended.



Boring Locations

TECHNOLOGY CLASSROOM BUILDING
ALCORN STATE UNIVERSITY
LORMAN, MISSISSIPPI

BURNS COOLEY DENNIS, INC.
551 SUNNYBROOK ROAD
RIDGELAND, MISSISSIPPI 39157

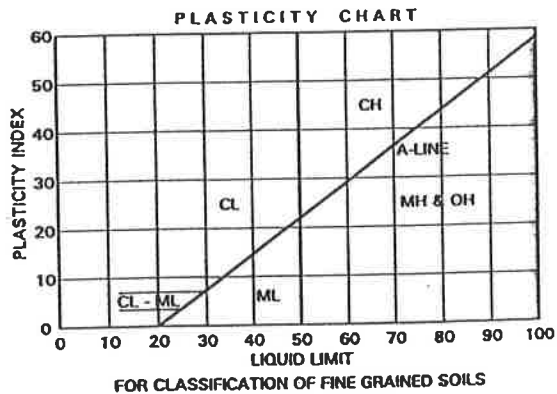
JOB NO. 160092 SCALE: AS SHOWN FIGURE 1

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		SYMBOL & LETTER	DESCRIPTION
COARSE-GRAINED SOILS More than half of material larger than No. 200 sieve size	GRAVELS More than half of coarse fraction larger than No. 4 sieve size	Clean Gravels (Little or no fines)	GW WELL GRADED GRAVEL, GRAVEL-SAND MIXTURE
			GP POORLY GRADED GRAVEL, GRAVEL-SAND MIXTURE
		Gravels with fines (Appreciable amount of fines)	GM SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURE
			GC CLAYEY GRAVEL, GRAVEL-SAND-CLAY MIXTURE
	SANDS More than half of coarse fraction smaller than No. 4 sieve size	Clean Sands (Little or no fines)	SW WELL GRADED SAND, GRAVELLY SAND
			SP POORLY GRADED SAND, GRAVELLY SAND
		Sands with fines (Appreciable amount of fines)	SM SILTY SAND, SAND-SILT MIXTURE
			SC CLAYEY SAND, SAND-CLAY MIXTURE
FINE-GRAINED SOILS More than half of material smaller than No. 200 sieve	SILTS AND CLAYS	Liquid limit less than 50	ML SILT WITH LITTLE OR NO PLASTICITY
			ML CLAYEY SILT, SILT WITH SLIGHT TO MEDIUM PLASTICITY
			CL SILTY CLAY, LOW TO MEDIUM PLASTICITY
			CL SANDY CLAY, LOW TO MEDIUM PLASTICITY (30% TO 50% SAND)
	SILTS AND CLAYS	Liquid limit greater than 50	MH SILT, FINE SANDY OR SILTY SOIL WITH HIGH PLASTICITY
			CH CLAY, HIGH PLASTICITY
			OH ORGANIC CLAY OF MEDIUM TO HIGH PLASTICITY
			PT PEAT, HUMUS, SWAMP SOIL
HIGHLY ORGANIC SOILS			

TERMS CHARACTERIZING SOIL STRUCTURE

- Slickensided** - Clays with polished and striated planes created as a result of volume changes related to shrinking, swelling and/or changes in overburden pressure.
- Fissured** - Clays with a blocky or jointed structure generally created by seasonal shrinking and swelling.
- Laminated** - Composed of thin alternating layers of varying color and texture.
- Calcareous** - Containing appreciable quantities of calcium carbonate.
- Parting Seam** - Paper thin (less than 1/8 inch).
- Layer** - 1/8 inch to 3 inch thickness.
- Greater than 3 inches in thickness.

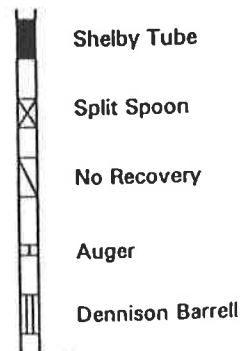


DENSITY AND CONSISTENCY

COARSE-GRAINED SOILS		FINE-GRAINED SOILS		
PENETRATION RESISTANCE, N	DENSITY	Blows per Foot	COHESION Kips/Sq.Ft	PENETRATION RESISTANCE, N
Very loose	0 - 4	Very Soft	< 0.25	0 - 1
Loose	5 - 10	Soft	0.25 - 0.50	2 - 4
Medium Dense	11 - 30	Medium Stiff	0.50 - 1.00	5 - 8
Dense	31 - 50	Stiff	1.00 - 2.00	9 - 15
Very Dense	> 50	Very Stiff	2.00 - 4.00	16 - 30
		Hard	> 4.00	> 30

PARTICLE SIZE IDENTIFICATION		RELATIVE COMPOSITION	
Cobbles	- Greater than 3 inches	Slightly	5 - 15%
Gravel	- Coarse - 3/4 inch to 3 inches	With	16 - 29%
	- Fine - 4.76 mm to 3/4 inch	Sandy	30 - 50%
Sand	- Coarse - 2 mm to 4.76mm	(or gravelly)	
	- Medium - 0.42 mm to 2 mm		
	- Fine - 0.074 mm to 0.42 mm		
Silt & Clay	- Less than 0.074 mm		

SAMPLE TYPES (Shown in Sample Column)



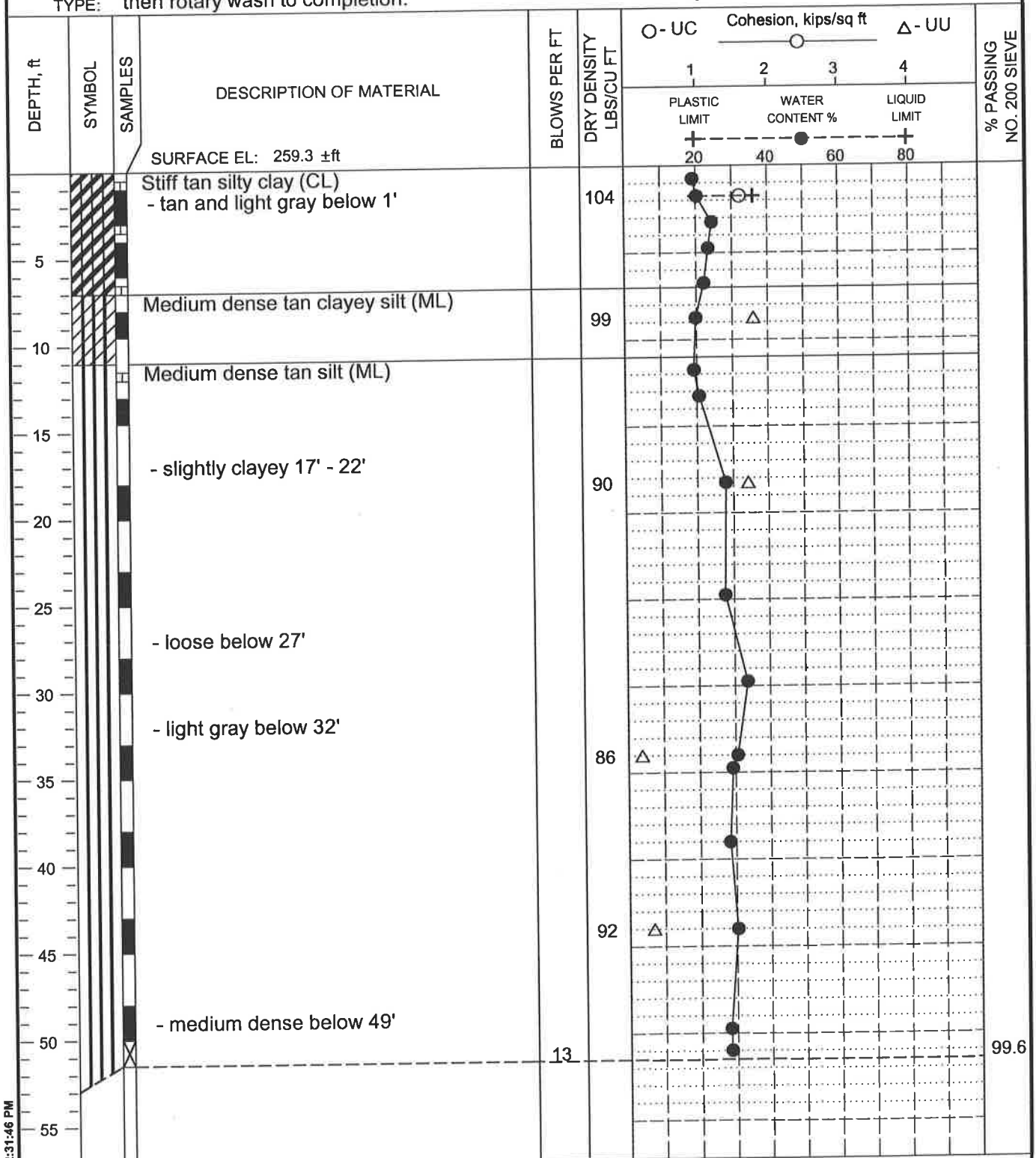
CLASSIFICATION, SYMBOLS AND TERMS USED ON GRAPHICAL BORING LOGS

LOG OF BORING NO. 1

TECHNOLOGY CLASSROOM BUILDING ALCORN STATE UNIVERSITY LORMAN, MISSISSIPPI

TYPE: 6" Short-flight auger to 15',
then rotary wash to completion.

LOCATION: See Figure 1



160092 3/25/2016 12:31:46 PM

BORING DEPTH: 51.5 ft

DATE: 03/08/16

COMMENTS: Borehole filled with cement-bentonite grout after completion of drilling and sampling.
GPS Coordinates
N 31° 52' 50.5"
W 91° 08' 23.5"

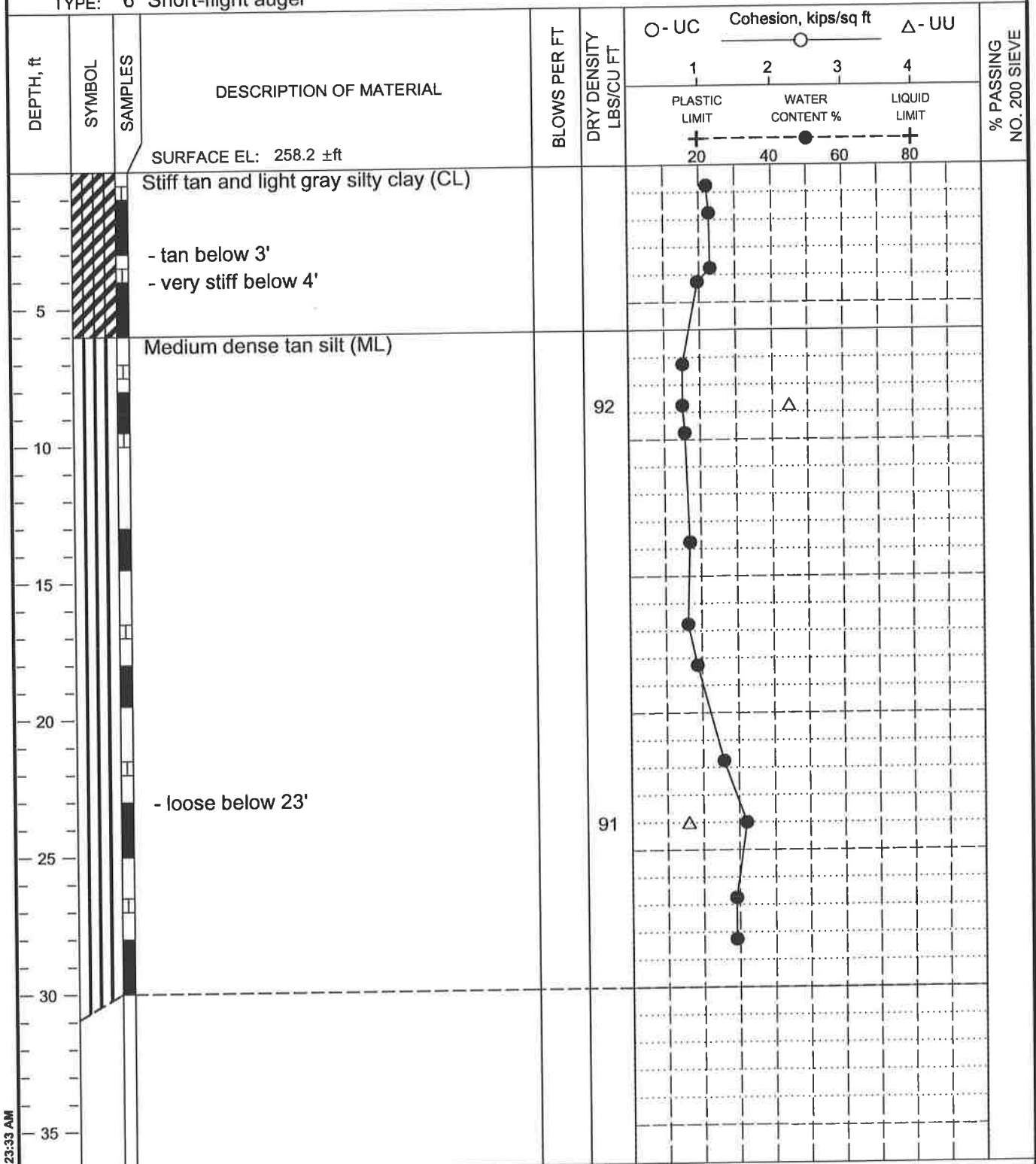
GROUNDWATER DATA: No free water encountered during auger drilling.

FIGURE 3

LOG OF BORING NO. 2
 TECHNOLOGY CLASSROOM BUILDING
 ALCORN STATE UNIVERSITY
 LORMAN, MISSISSIPPI

TYPE: 6" Short-flight auger

LOCATION: See Figure 1



160092 3/25/2016 9:23:33 AM

BORING DEPTH: 30 ft

DATE: 03/08/16

COMMENTS: Borehole filled with cement-bentonite grout after completion of drilling and sampling.
GPS Coordinates
 N 31° 52' 51.4"
 W 91° 08' 24.7"

GROUNDWATER DATA: No free water encountered during auger drilling.

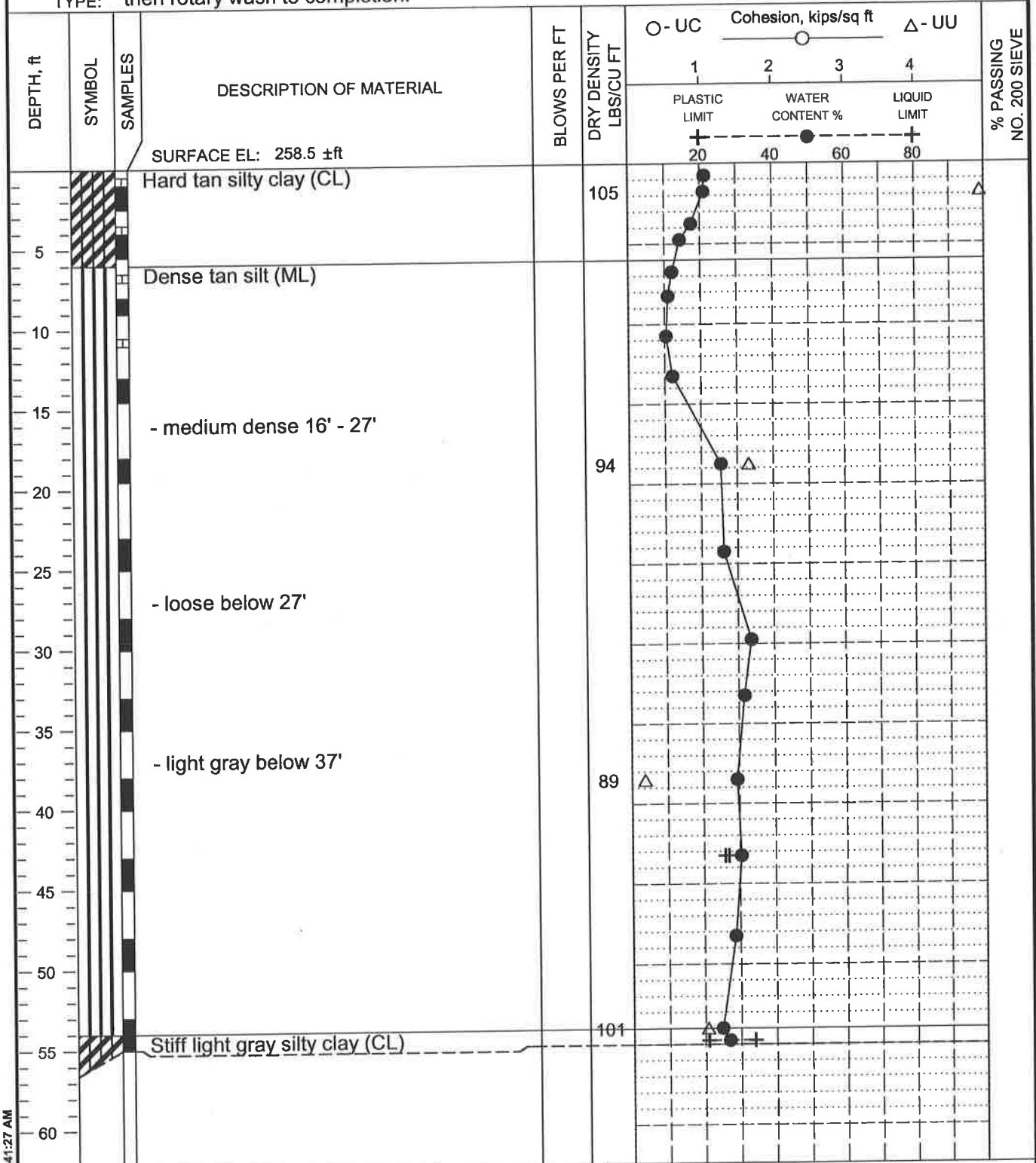
FIGURE 4

LOG OF BORING NO. 3

TECHNOLOGY CLASSROOM BUILDING ALCORN STATE UNIVERSITY LORMAN, MISSISSIPPI

TYPE: 6" Short-flight auger to 15', then rotary wash to completion.

LOCATION: See Figure 1



BORING DEPTH: 55 ft	COMMENTS: Borehole filled with cement-bentonite grout after completion of drilling and sampling. GPS Coordinates N 31° 52' 50.8" W 91° 08' 25.8"	GROUNDWATER DATA: No free water encountered during auger drilling.
DATE: 03/09/16		

160092 3/25/2016 9:41:27 AM

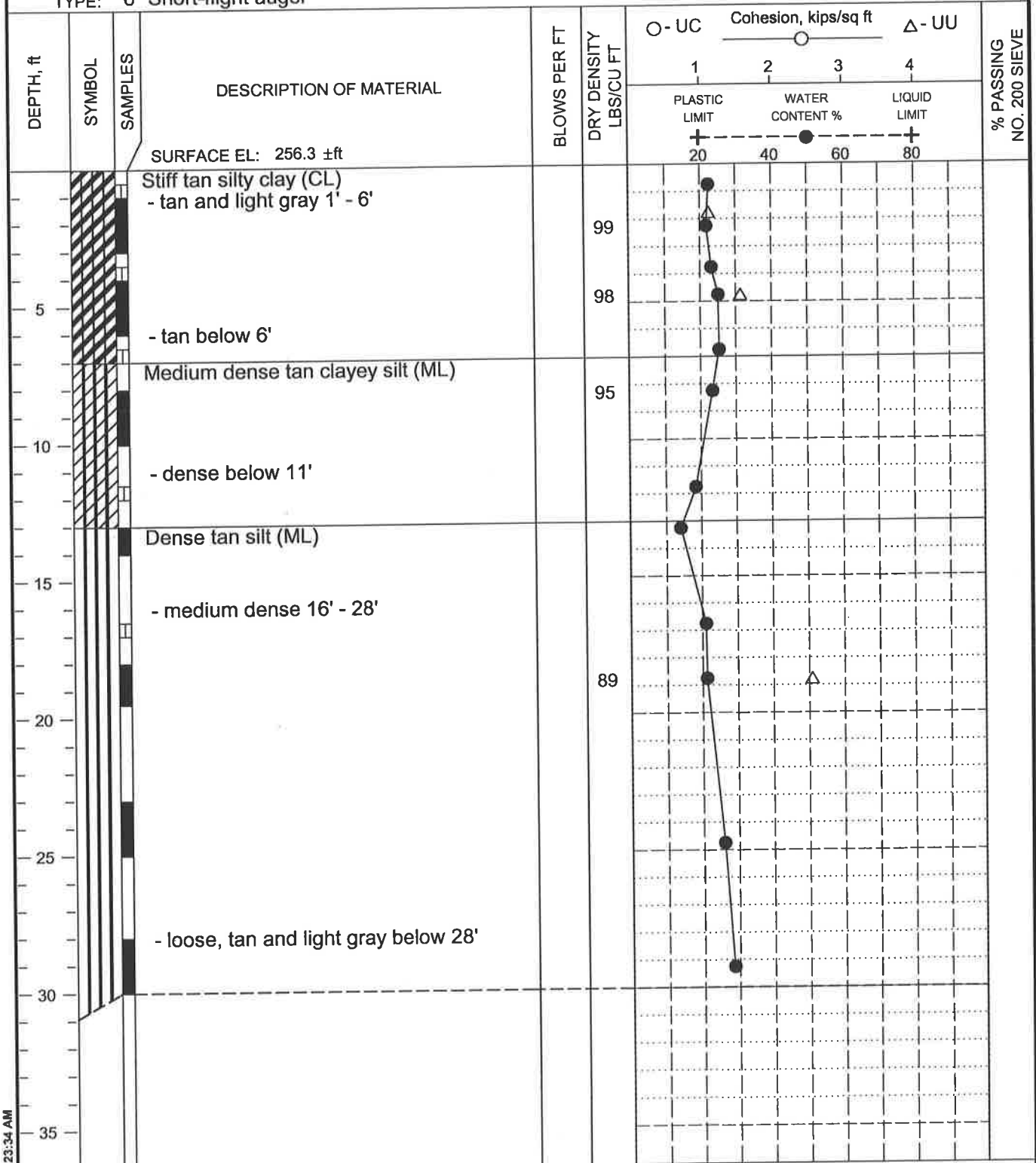
FIGURE 5

LOG OF BORING NO. 4

TECHNOLOGY CLASSROOM BUILDING ALCORN STATE UNIVERSITY LORMAN, MISSISSIPPI

TYPE: 6" Short-flight auger

LOCATION: See Figure 1



160092 3/25/2016 9:23:34 AM

BORING DEPTH: 30 ft

DATE: 03/14/16

COMMENTS: Borehole filled with cement-bentonite grout after completion of drilling and sampling.
GPS Coordinates
N 31° 52' 51.1"
W 91° 08' 24.4"

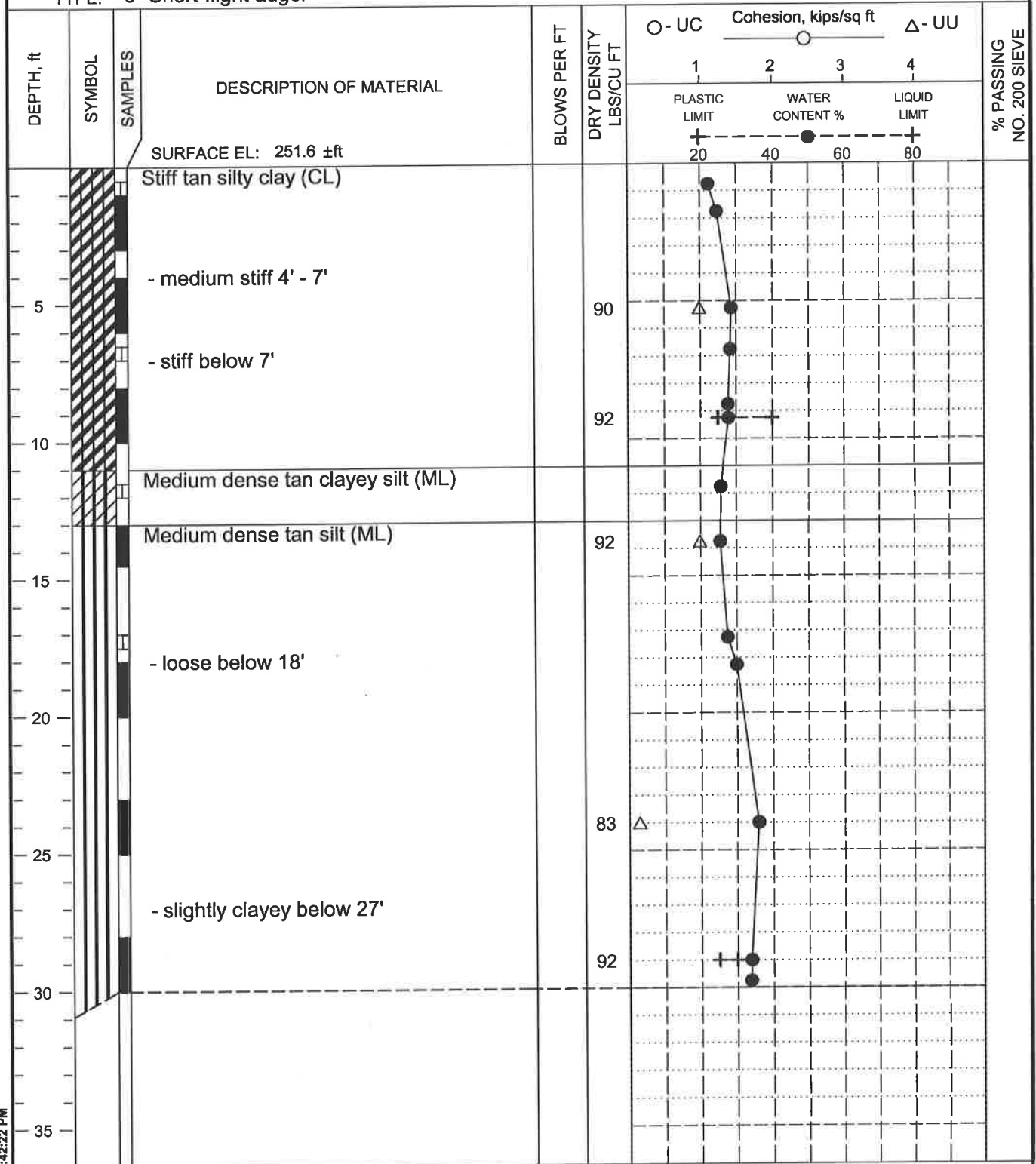
GROUNDWATER DATA: No free water encountered during auger drilling.

FIGURE 6

LOG OF BORING NO. 5
 TECHNOLOGY CLASSROOM BUILDING
 ALCORN STATE UNIVERSITY
 LORMAN, MISSISSIPPI

TYPE: 6" Short-flight auger

LOCATION: See Figure 1



160092 3/29/2016 2:42:22 PM

BORING DEPTH: 30 ft

DATE: 03/08/16

COMMENTS: Borehole filled with cement-bentonite grout after completion of drilling and sampling.
GPS Coordinates
 N 31° 52' 51.6"
 W 91° 08' 23.1"

GROUNDWATER DATA: No free water encountered during auger drilling.

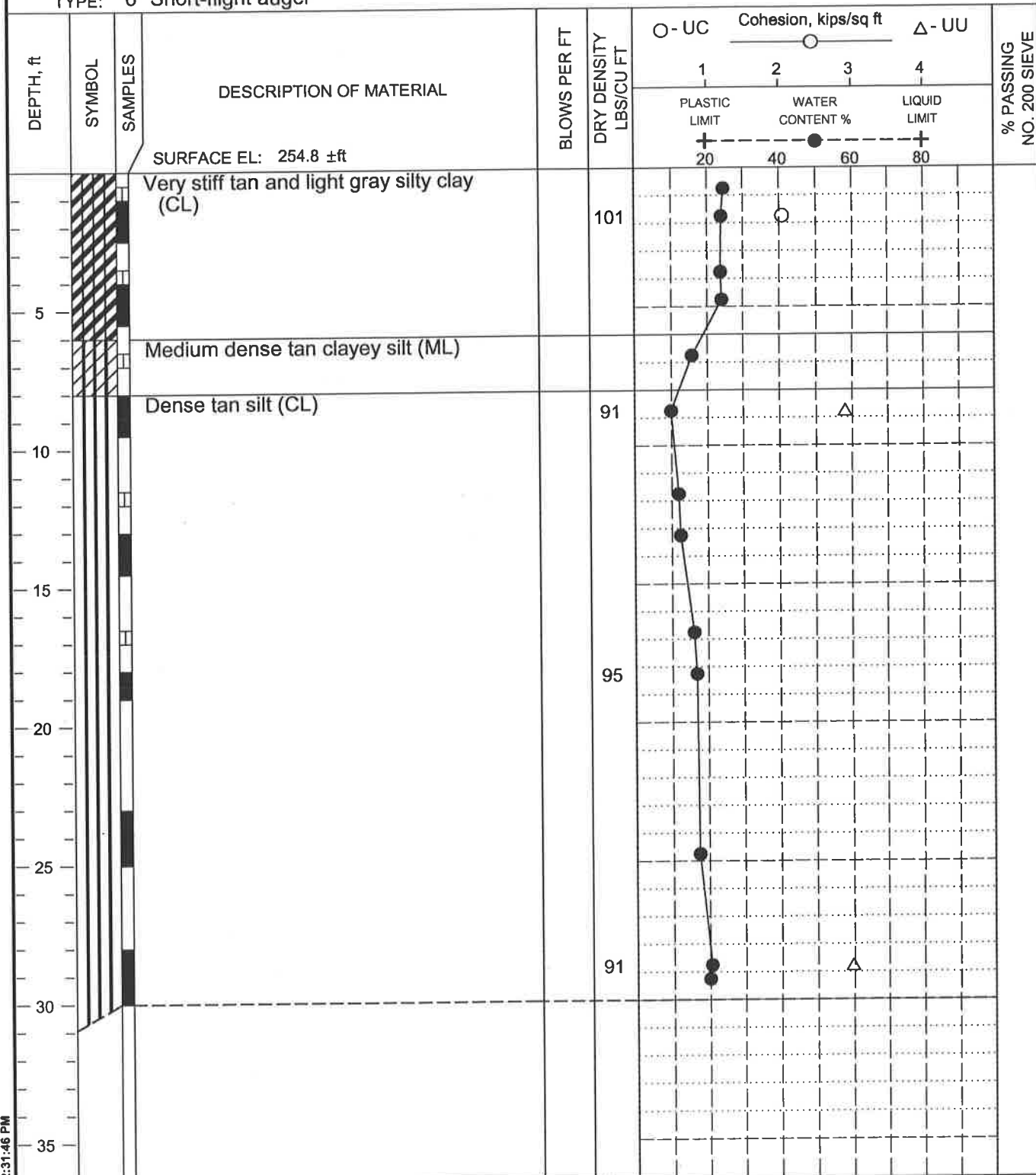
FIGURE 7

LOG OF BORING NO. 6

TECHNOLOGY CLASSROOM BUILDING
ALCORN STATE UNIVERSITY
LORMAN, MISSISSIPPI

TYPE: 6" Short-flight auger

LOCATION: See Figure 1



160092 3/25/2016 12:31:46 PM

BORING DEPTH: 30 ft	COMMENTS: Borehole filled with cement-bentonite grout after completion of drilling and sampling. <u>GPS Coordinates</u> N 32° 52' 51.9" W 91° 08' 26.3"	GROUNDWATER DATA: No free water encountered during auger drilling.
DATE: 03/14/16		

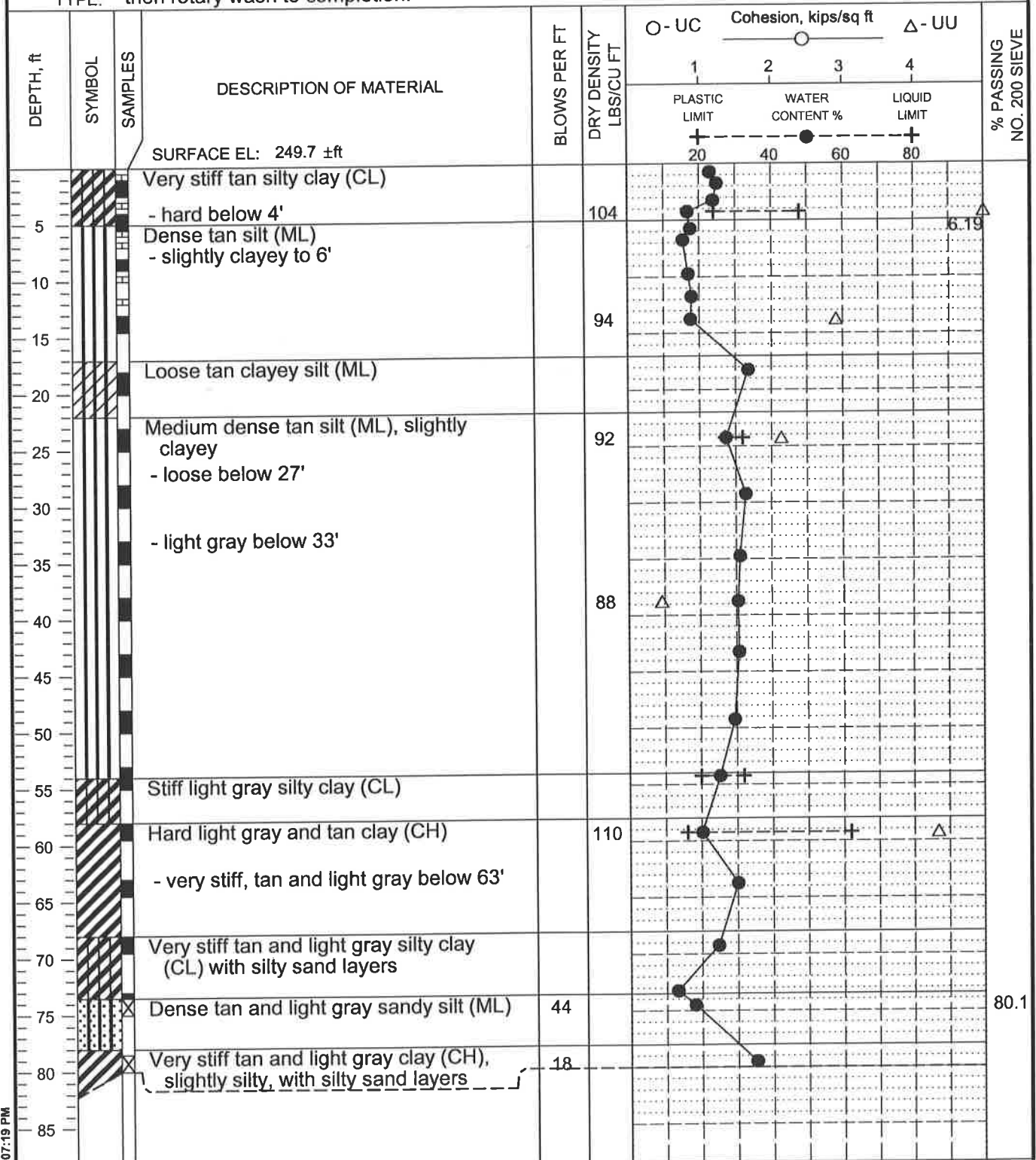
FIGURE 8

LOG OF BORING NO. 7

TECHNOLOGY CLASSROOM BUILDING ALCORN STATE UNIVERSITY LORMAN, MISSISSIPPI

TYPE: 6" Short-flight auger to 15',
then rotary wash to completion.

LOCATION: See Figure 1



160092 3/25/2016 1:07:19 PM

BORING DEPTH: 80 ft

DATE: 02/29/16 &
03/01/16

COMMENTS: Borehole filled with cement-bentonite grout after completion of drilling and sampling.
GPS Coordinates
N 31° 52' 52.0"
W 91° 08' 29.0"

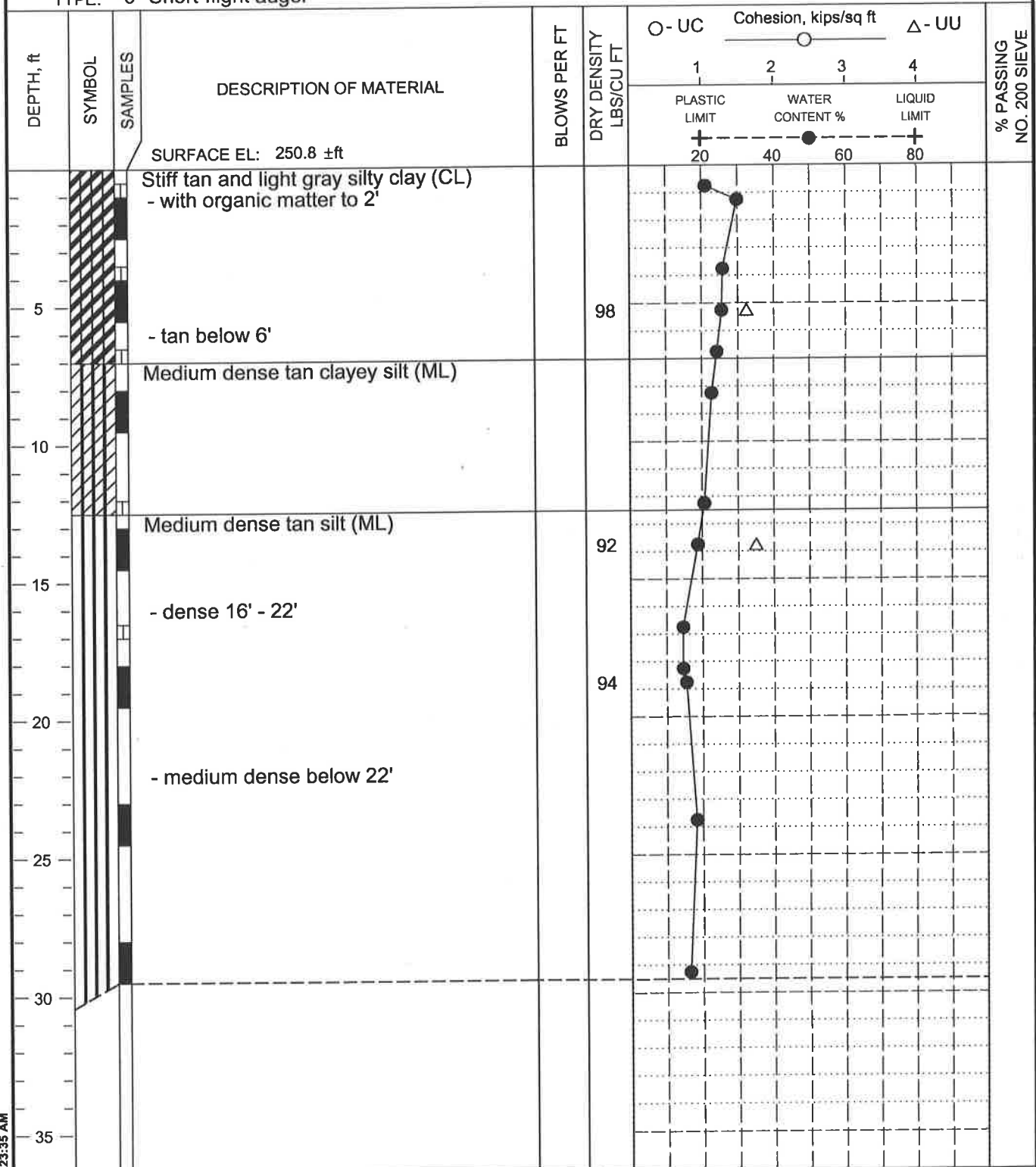
GROUNDWATER DATA: No free water encountered during auger drilling.

FIGURE 9

LOG OF BORING NO. 8
 TECHNOLOGY CLASSROOM BUILDING
 ALCORN STATE UNIVERSITY
 LORMAN, MISSISSIPPI

TYPE: 6" Short-flight auger

LOCATION: See Figure 1



160092 3/25/2016 9:23:35 AM

BORING DEPTH: 29.5 ft

DATE: 03/14/16

COMMENTS: Borehole filled with cement-bentonite grout after completion of drilling and sampling.
GPS Coordinates
 N 31° 52' 52.5"
 W 91° 08' 25.0"

GROUNDWATER DATA: No free water encountered during auger drilling.

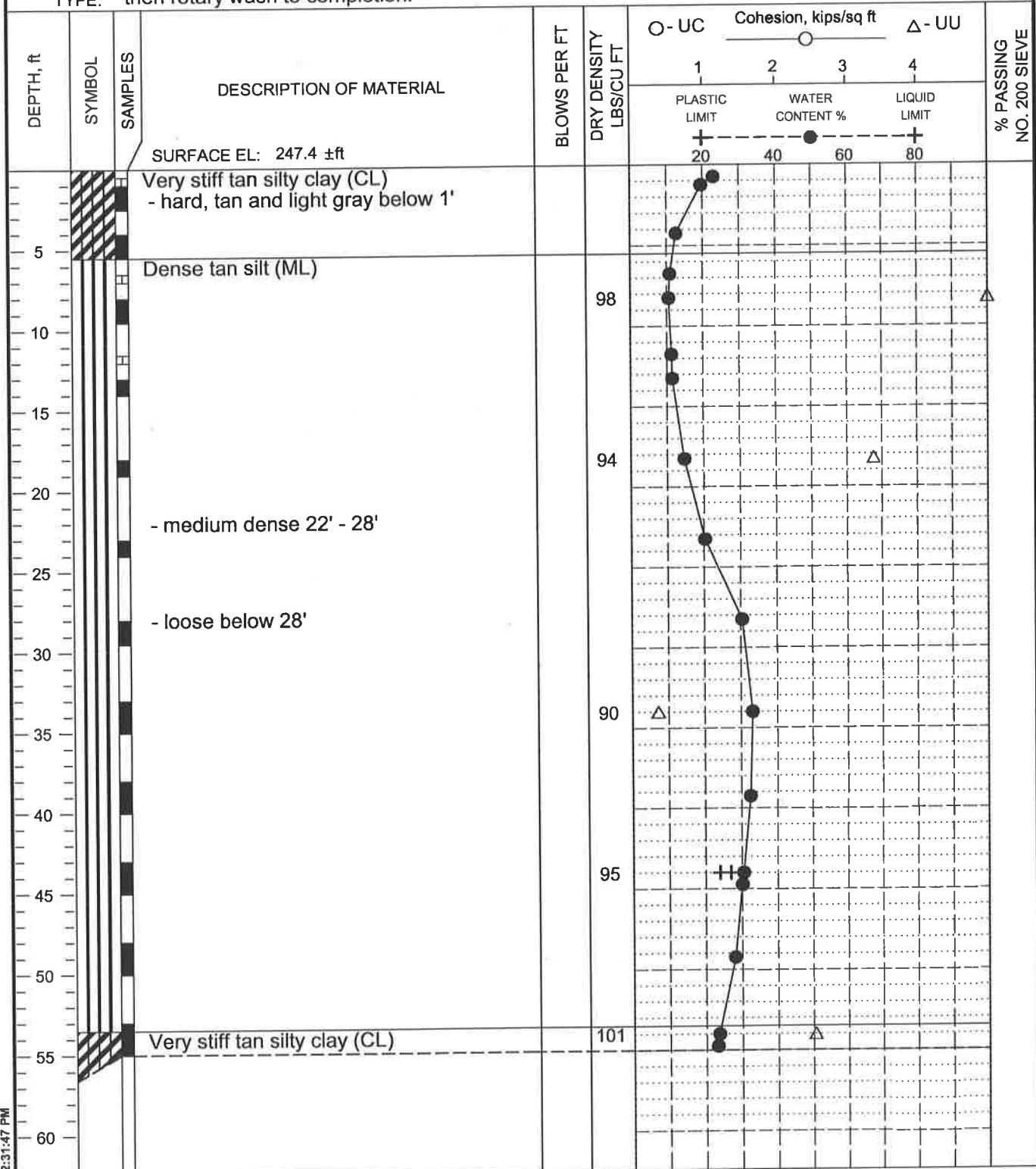
FIGURE 10

LOG OF BORING NO. 9

TECHNOLOGY CLASSROOM BUILDING
ALCORN STATE UNIVERSITY
LORMAN, MISSISSIPPI

TYPE: 6" Short-flight auger to 15',
then rotary wash to completion.

LOCATION: See Figure 1



160092 3/25/2016 12:31:47 PM

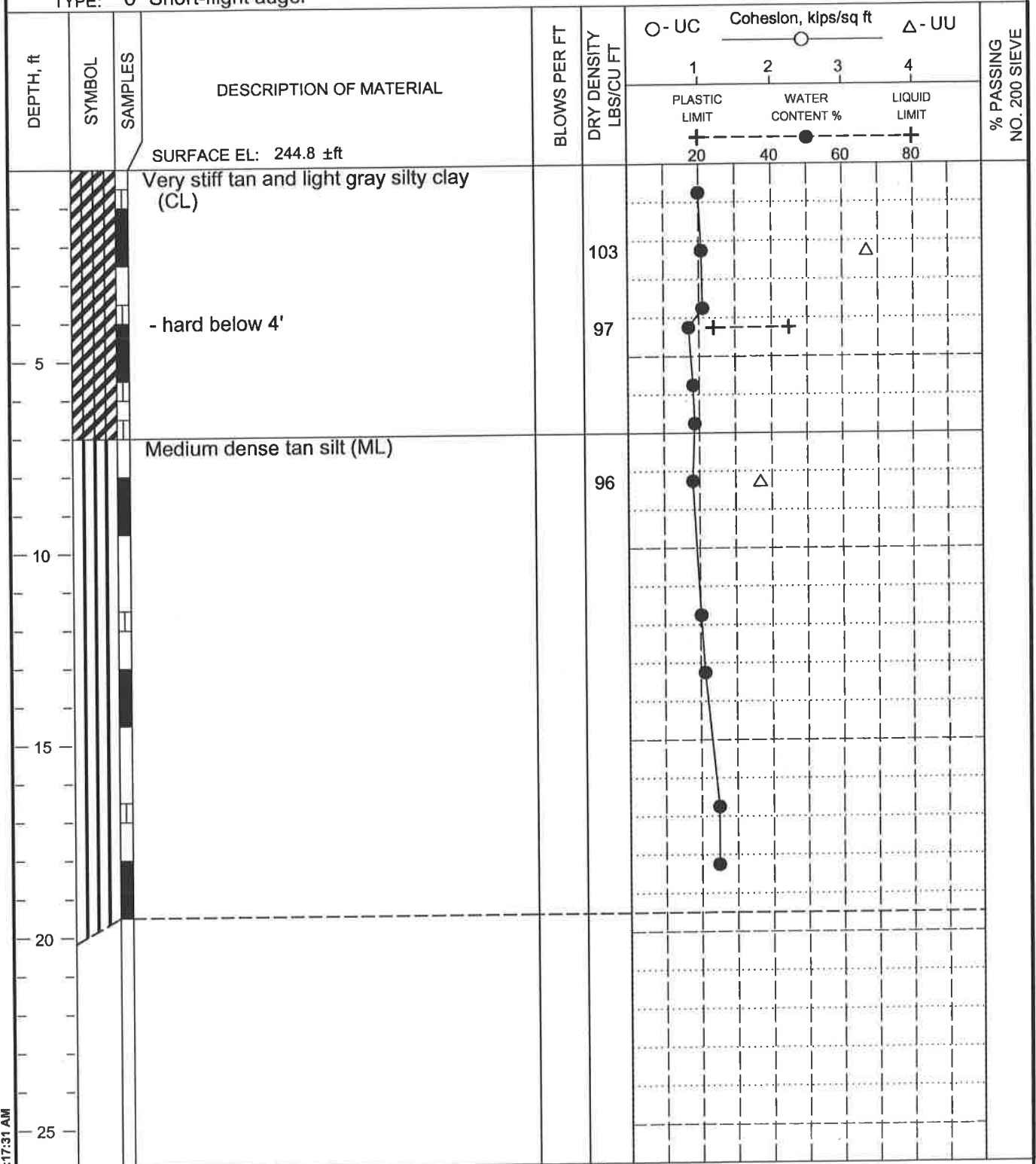
BORING DEPTH: 55 ft	COMMENTS: Borehole filled with cement-bentonite grout after completion of drilling and sampling. <u>GPS Coordinates</u> N 31° 52' 53.5" W 91° 08' 23.8"	GROUNDWATER DATA: No free water encountered during auger drilling.
DATE: 03/02/16 & 03/07/16		

FIGURE 11

LOG OF BORING NO. 10
 TECHNOLOGY CLASSROOM BUILDING
 ALCORN STATE UNIVERSITY
 LORMAN, MISSISSIPPI

TYPE: 6" Short-flight auger

LOCATION: See Figure 1



160092 3/29/2016 9:17:31 AM

BORING DEPTH: 19.5 ft

DATE: 03/07/16

COMMENTS: Borehole plugged with soil cuttings after completion of drilling and sampling.
GPS Coordinates
 N 31° 52' 52.9"
 W 91° 08' 22.8"

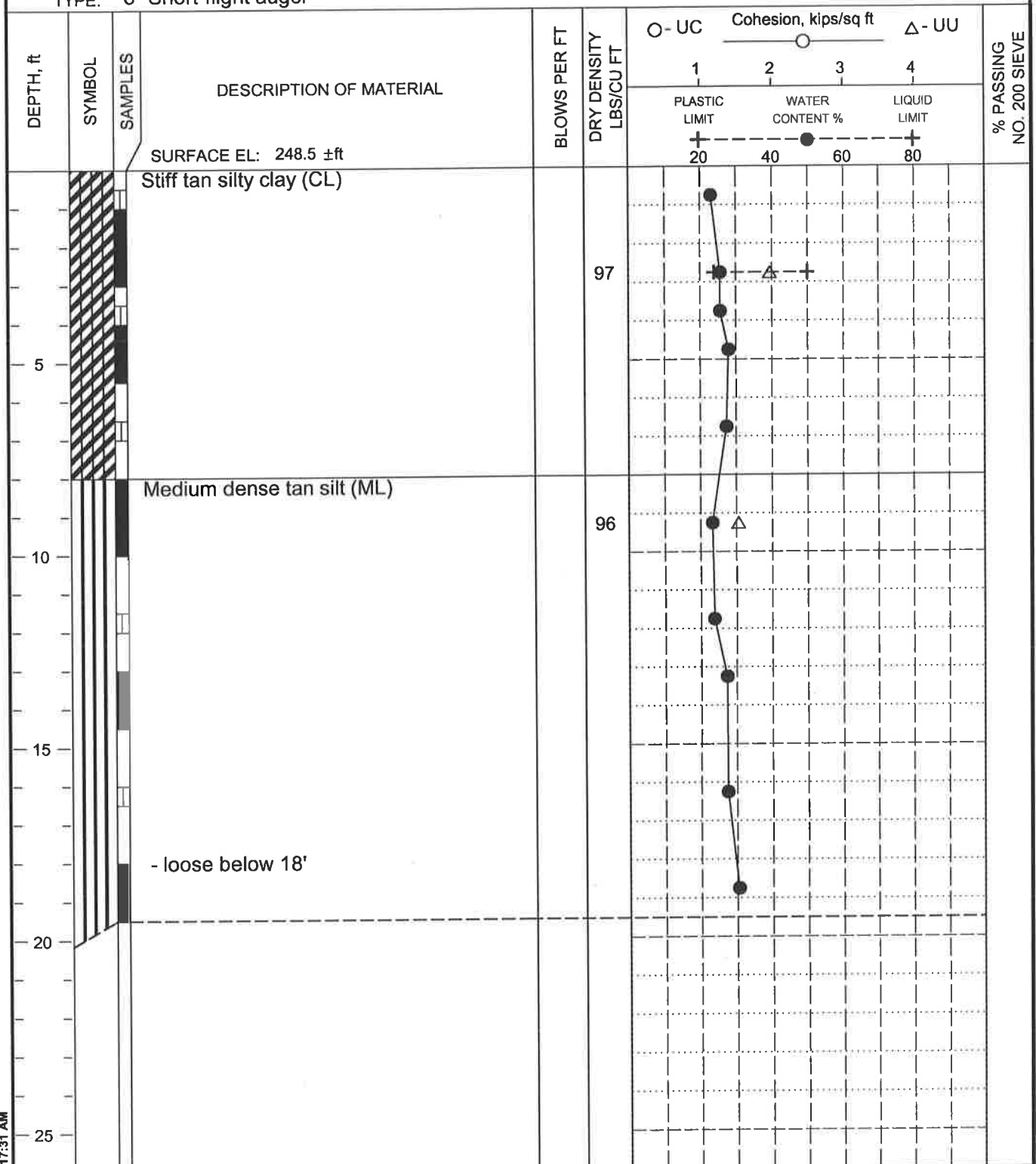
GROUNDWATER DATA: No free water encountered during auger drilling.

FIGURE 12

LOG OF BORING NO. 11
TECHNOLOGY CLASSROOM BUILDING
ALCORN STATE UNIVERSITY
LORMAN, MISSISSIPPI

TYPE: 6" Short-flight auger

LOCATION: See Figure 1



BORING DEPTH: 19.5 ft

DATE: 03/07/16

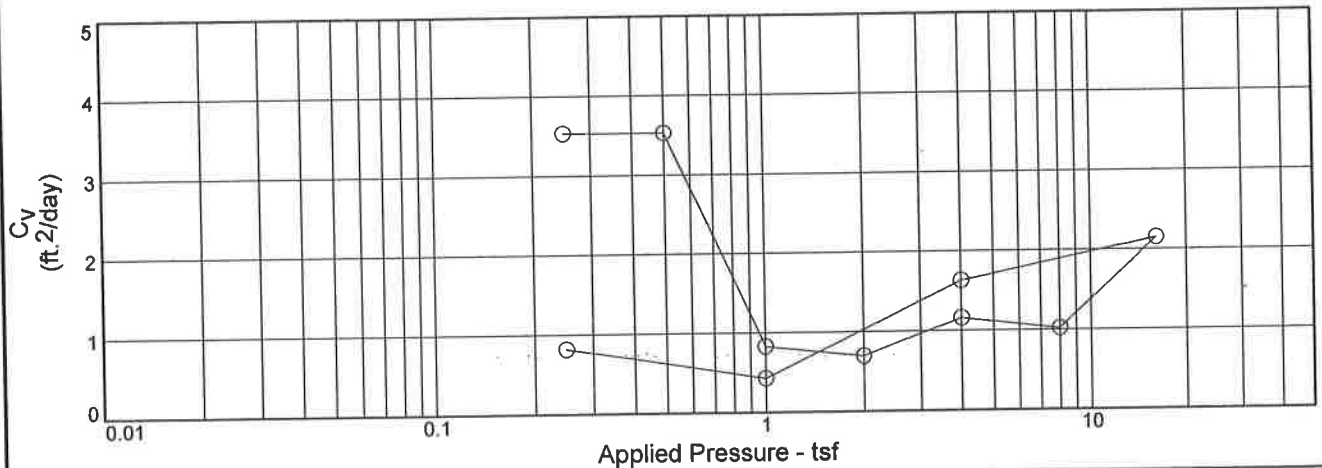
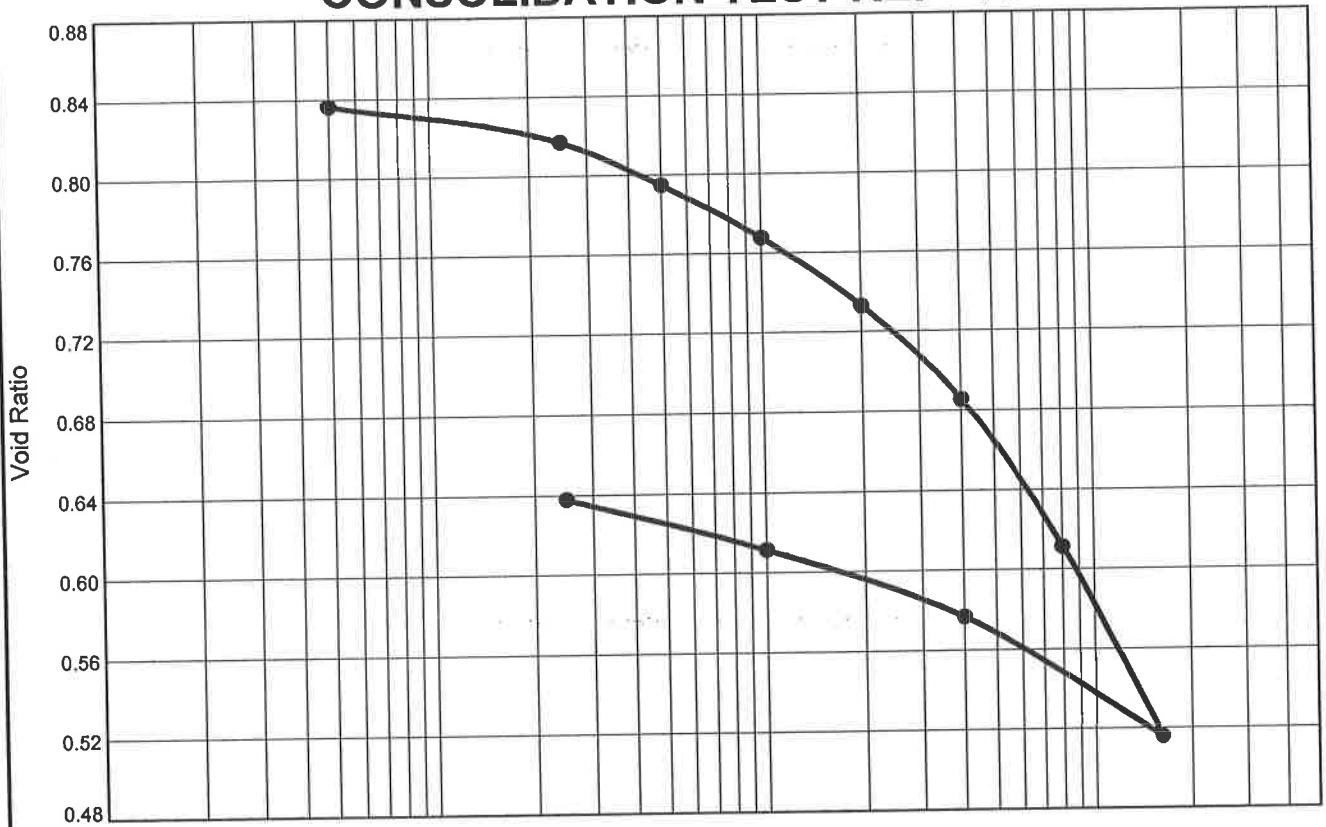
COMMENTS: Borehole plugged with soil cuttings after completion of drilling and sampling.
GPS Coordinates
 N 31° 52' 52.2"
 W 91° 08' 22.5"

GROUNDWATER DATA: No free water encountered during auger drilling.

160092 3/29/2016 9:17:31 AM

FIGURE 13

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
90.3 %	27.9 %	91.8	40	15	2.70	CL		0.835

MATERIAL DESCRIPTION

Stiff tan silty clay (CL)

Project No. 160092 **Client:** Allred Architectural Group
Project: Technology Classroom Building, Alcorn State University, Lorman, Mississippi

Source of Sample: B-5 **Depth:** 9.25' **Sample Number:** 8

BURNS COOLEY DENNIS, INC.

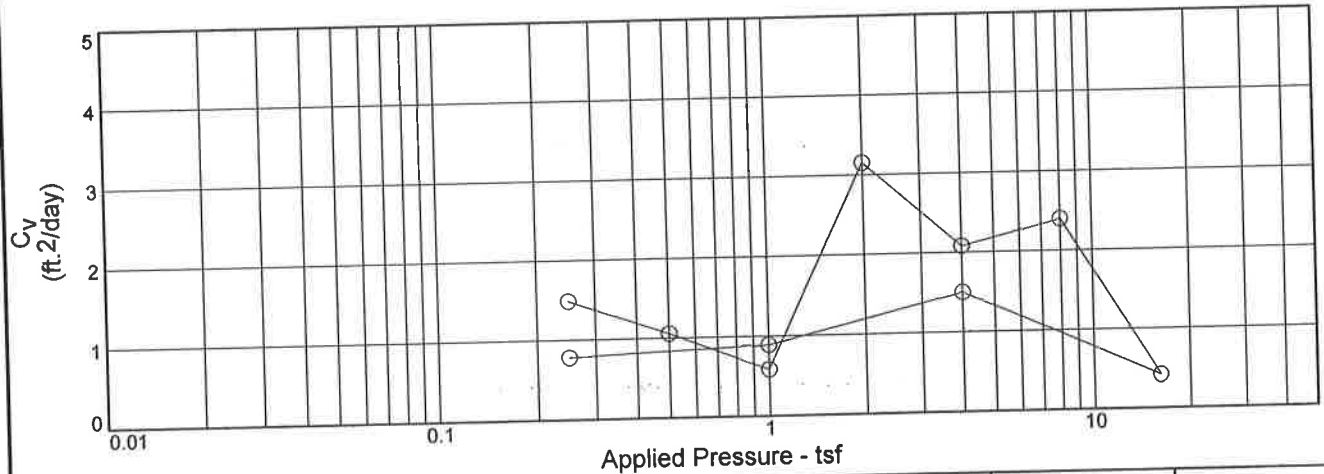
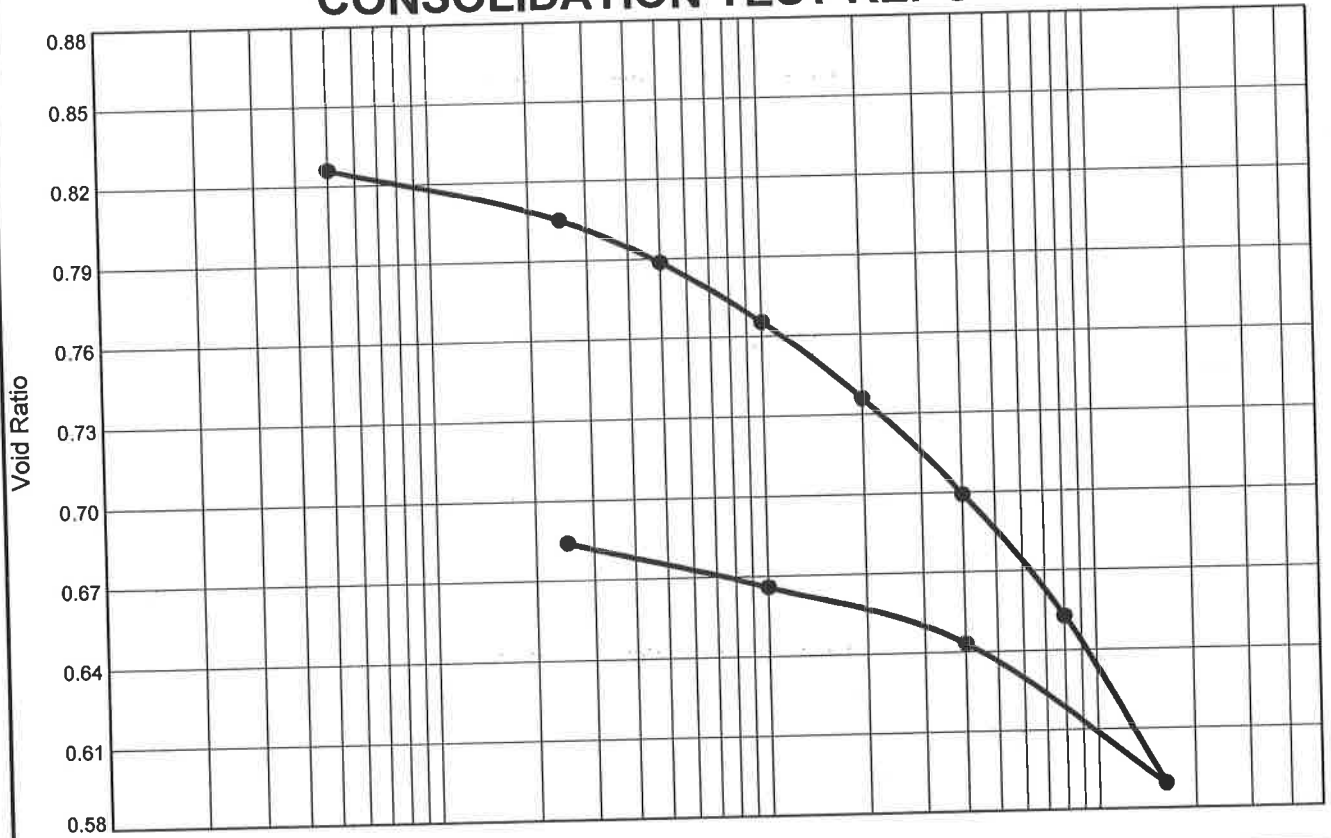
Ridgeland, Mississippi

Remarks:
Specific Gravity is estimated.

Figure 14

Tested By: ah _____ **Checked By:** _____

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
110.4 %	33.9 %	91.9	30	5	2.69	ML		0.826

MATERIAL DESCRIPTION

Loose tan silt (ML), slightly clayey

Project No. 160092 **Client:** Allred Architectural Group
Project: Technology Classroom Building, Alcorn State University, Lorman, Mississippi
Source of Sample: B-5 **Depth:** 29.0' **Sample Number:** 17
BURNS COOLEY DENNIS, INC.

Ridgeland, Mississippi

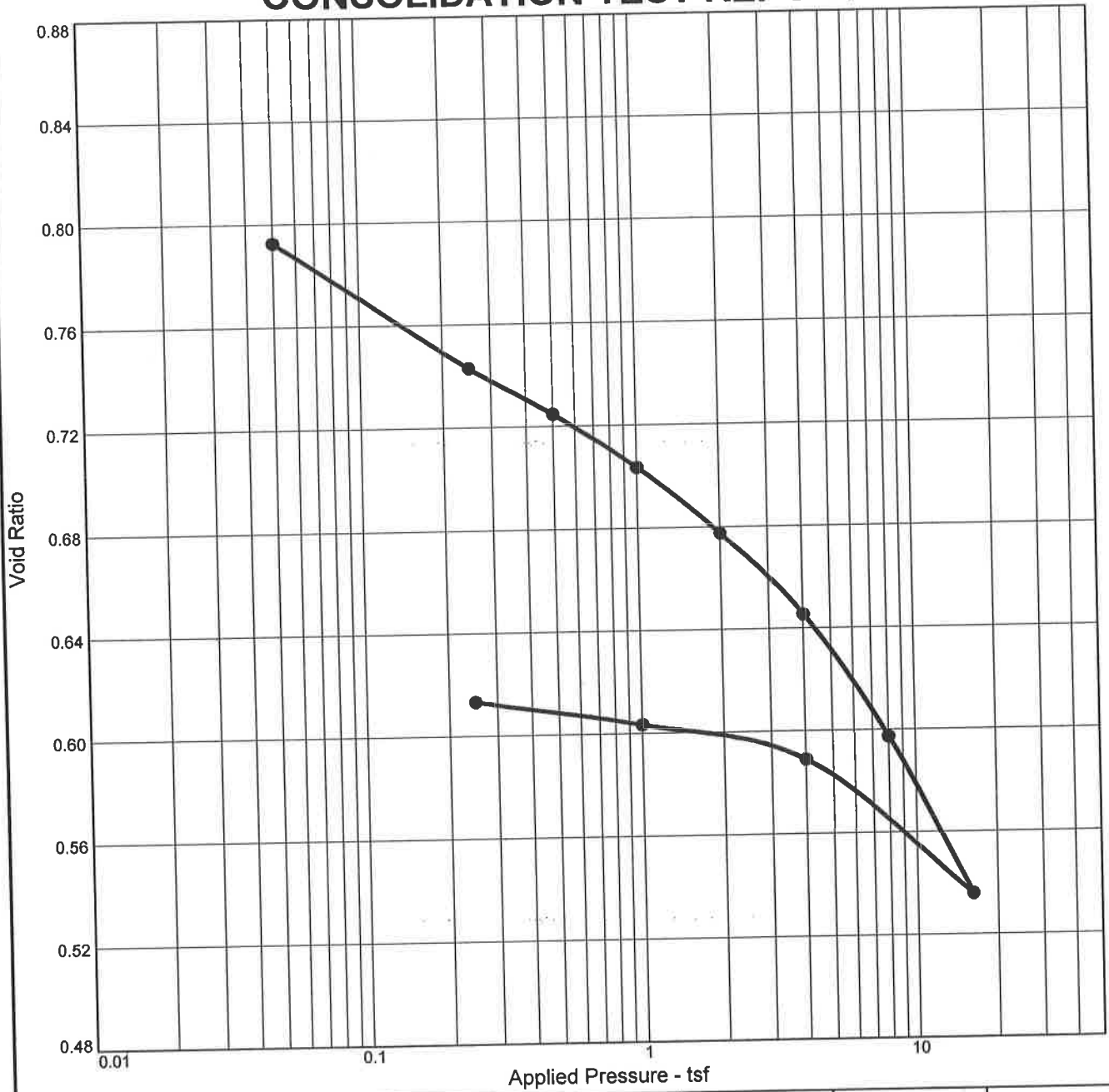
Remarks:

Specific Gravity is estimated.
 Saturation = 100% - disregard tabulated value.

Figure 15

Tested By: ah _____ **Checked By:** _____

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
105.9 %	30.5 %	94.8	27	3	2.70	ML		0.778

MATERIAL DESCRIPTION

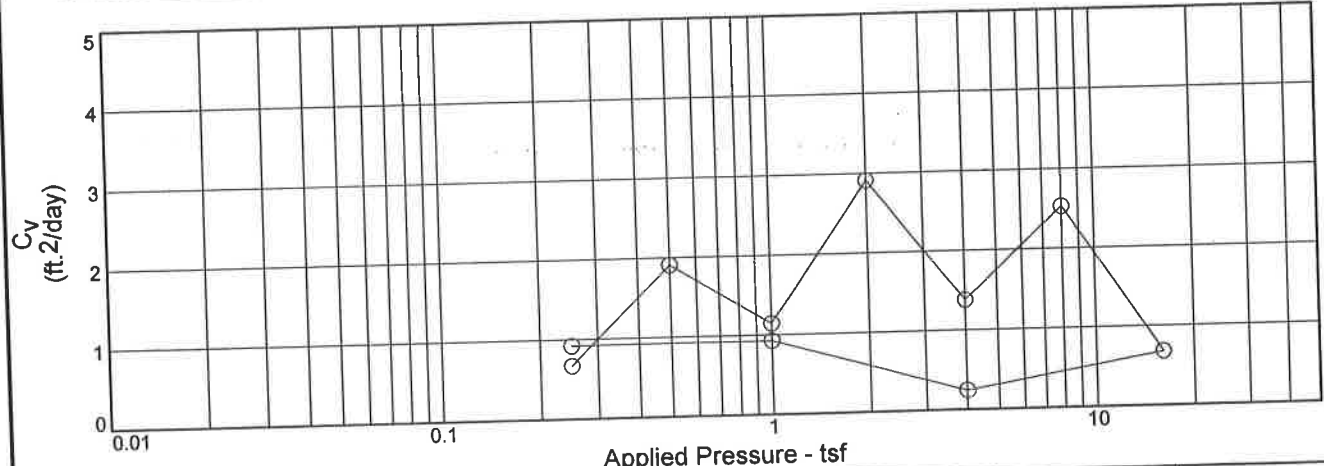
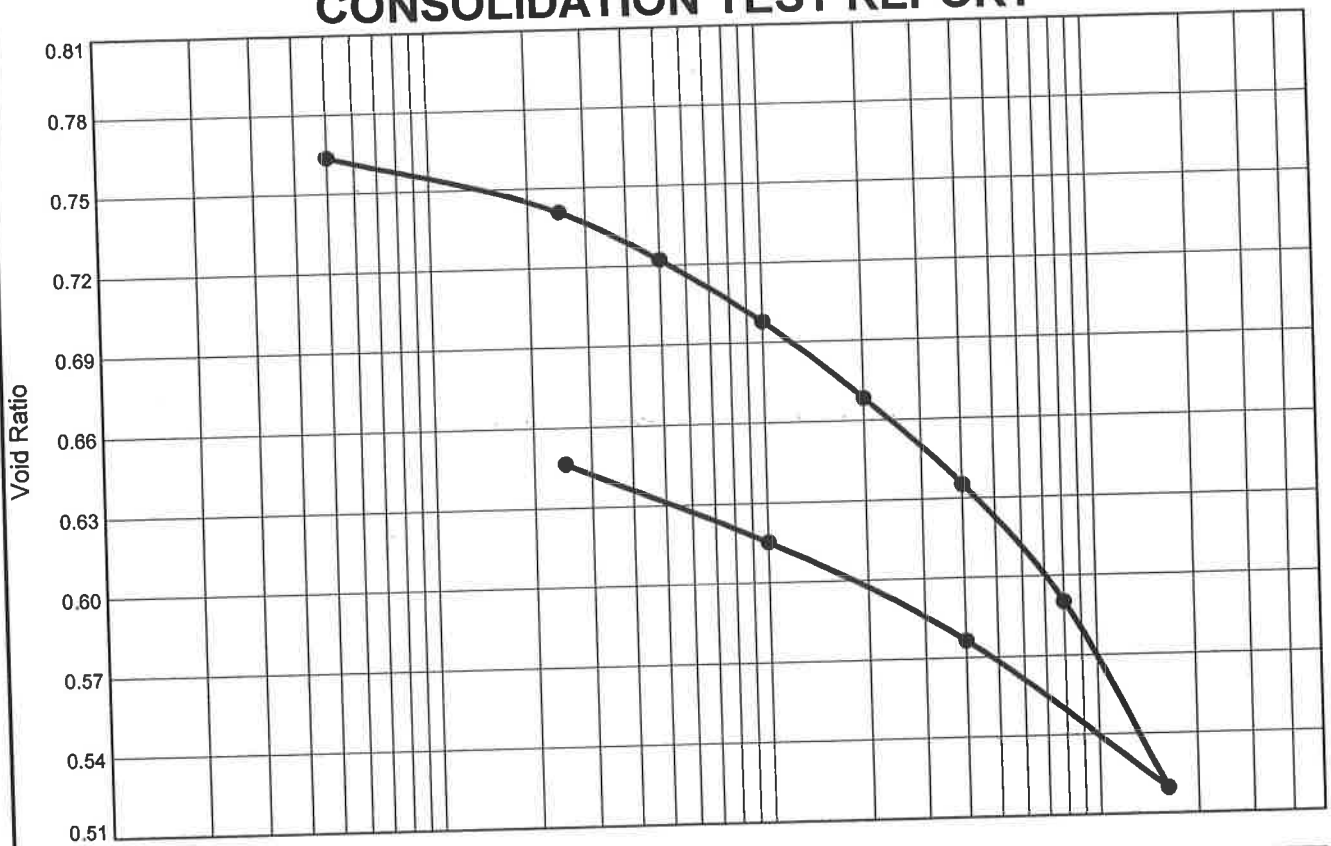
Loose tan silt (ML)

Project No. 160092	Client: Allred Architectural Group	Remarks: Specific Gravity is estimated. Saturation = 100% - disregard tabulated value.
Project: Technology Classroom Building, Alcorn State University, Lorman, Mississippi		
Source of Sample: B-9	Depth: 44.0'	
BURNS COOLEY DENNIS, INC.		
Ridgeland, Mississippi		

Figure 16

Tested By: ah Checked By: _____

CONSOLIDATION TEST REPORT



Natural	Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture						
63.2 %	17.1 %	97.3	45	21	2.70	CL	0.732

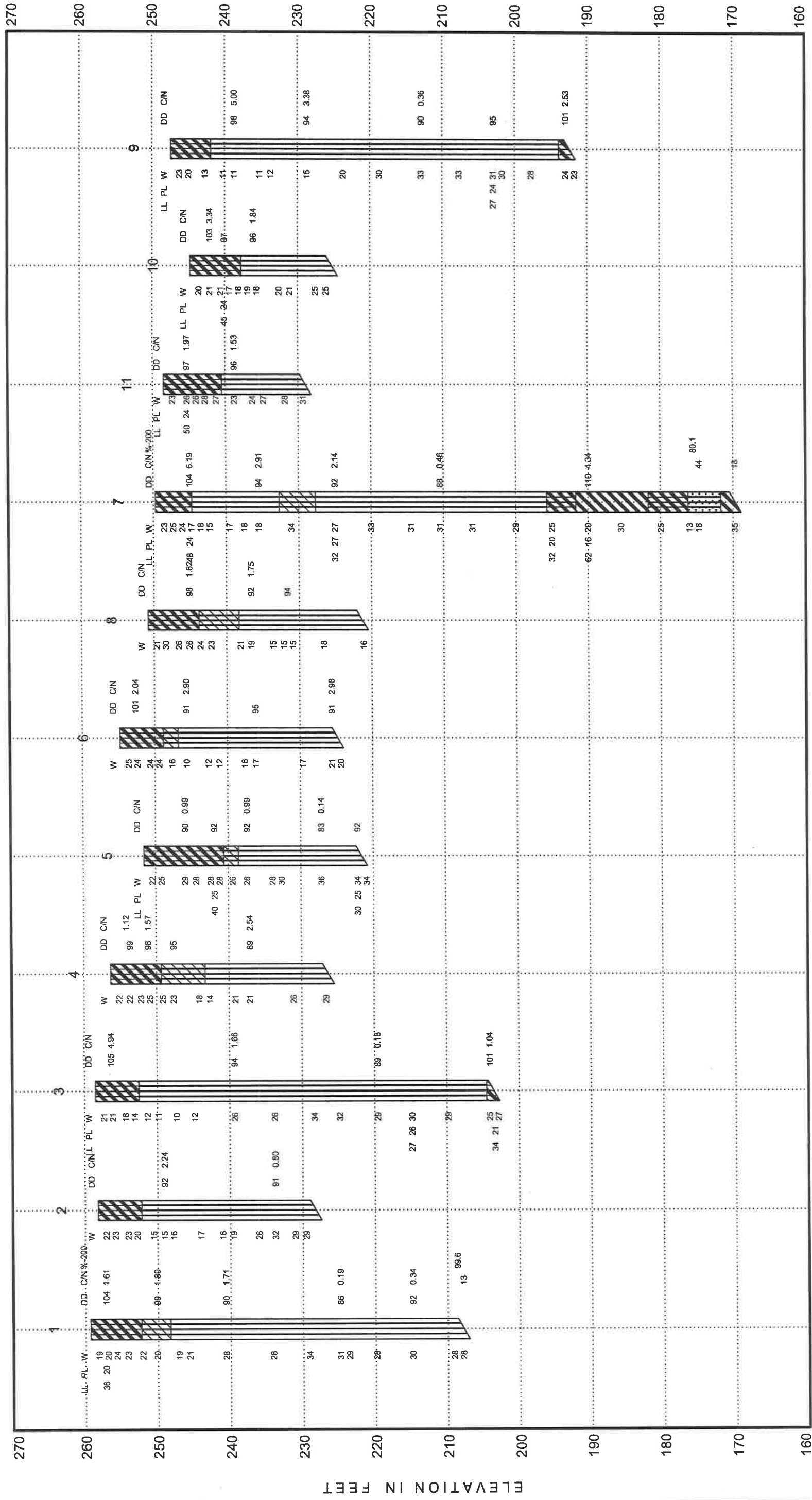
MATERIAL DESCRIPTION

Hard tan and light gray silty clay (CL)

Project No. 160092 Project: Technology Classroom Building, Alcorn State University, Lorman, Mississippi Source of Sample: B-10 Depth: 4.25' Sample Number: 5 BURNS COOLEY DENNIS, INC. Ridgeland, Mississippi	Client: Allred Architectural Group Remarks: Specific Gravity is estimated.
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------

Figure 17

Tested By: ah _____ Checked By: _____



LEGEND:

- LL = Liquid Limit
- PL = Plastic Limit
- W = Water Content
- DD = Dry Density (pcf)
- C/N = Cohesion (ksf)/Penetration Resistance, N (blows per ft) in the same column
- % -200 = % Passing No. 200 Sieve

NOTE: See Figure 2 for boring log legend.

SUBSURFACE SOIL PROFILE

TECHNOLOGY CLASSROOM BUILDING
 ALCORN STATE UNIVERSITY
 LORMAN, MISSISSIPPI