PROJECT MANUAL
VOLUME 1

GS# 211-071

Hayden Hall Renovation

Mississippi Gulf Coast Community College
Perkinston, MS

OWNER
Bureau of Building, Grounds, & Real Property Management
501 North West Street, Suite 1401B
Jackson, Mississippi 39201
601.359.3621

REGISTERED ARCHITECT
Kyle L. Kish
4202
STATE OF MISSISSIPPI

ARCHITECT
Eley Guild Hardy Architects, P.A.
1091 Tommy Munro Drive
Biloxi, Mississippi 39532
228.594.2323

Date: 27 June 2023

A/E PROJECT NO: 22-050

GS# 211-071
Hayden Hall Renovation
Mississippi Gulf Coast Community College
Perkinston, Mississippi

OWNER
Bureau of Building, Grounds & Real Property Management
501 North West Street, Suite 1401B
Jackson, Mississippi 39201

ARCHITECT
Eley Guild Hardy Architects, P.A.
1091 Tommy Munro Dr.
Biloxi, MS 39532
(228) 594-2323

CIVIL ENGINEER
O'Neal Bond Engineering, Inc.
312 Mill Avenue
Wiggins, MS 39577
(601) 928-7390

MECHANICAL ENGINEER
Stephens Mechanical Engineering, LLC
925 Tommy Munro Dr.
Biloxi, MS 39532
(228) 207-3322

STRUCTURAL ENGINEER
Simpkins & Costelli, Inc.
401 32nd ½ Street
Gulfport, MS 39507
(228) 864-6289

ELECTRICAL ENGINEER
Welcon Electrical Consultants
14116 Customs Blvd, Suite 111
Gulfport, MS 39503
(228) 822-8000

COMMISSIONING
Sinergi Consulting
P.O. Box 4297
Jackson, MS 39396
(601) 668-8781

00 01 10 – PROJECT MANUAL TABLE OF CONTENTS

FACILITY SERVICES SUBGROUP

SITE AND INFRASTRUCTURE SUBGROUP

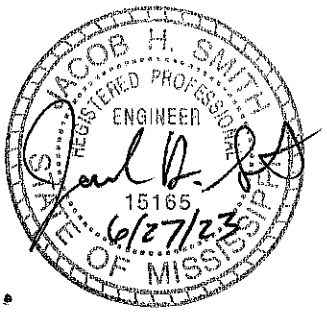
MECHANICAL INDEX TO SPECIFICATIONS

END OF SECTION

26 00 00 – ELECTRICAL TABLE OF CONTENTS

SITE WORK
TECHNICAL SPECIFICATIONS

HAYDEN HALL RENOVATION
MGCCC PERKINSTON CAMPUS
22-050



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

ADVERTISEMENT FOR BIDS

Sealed bids will be received electronically via MAGIC or physically delivered to the office of 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. (14:00:00 Military Time) on Thursday, 07/27/2023, for:

RE: GS# 211-071 Hayden Hall Renovations (Bid Advertisement Request)
Mississippi Gulf Coast Community College
RFx # 3160005979

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

Professional:	Eley Guild Hardy Architects, PA (Biloxi, Mississippi)
Address:	1091 Tommy Munro Drive
	Biloxi, Mississippi 39532
Phone:	228-594-2323
Email:	kkish@egh.ms

A deposit of $200.00 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.**

Bureau of Building, Grounds and Real Property Management

Dates of Publication:

06/27/2023
07/04/2023

Note: Whenever reference is made, in any document or meeting, to 2:00:00 p.m., it shall also mean, and be the same as, 14:00:00 Military Time.

INSTRUCTIONS TO BIDDERS
SECTION 00 2100

PART 1 - GENERAL

1.01 **QUESTIONS:** Questions should be directed to the Professional. Should a Bidder find discrepancies in, or omissions from, the procurement documents, 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 of 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* shall 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 shall 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 shall 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 shall 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: (Code 31-3-21(3))

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.

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:

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.

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.

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.

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.

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 exactly as recorded at the Secretary of State, which should also be the same as at the Mississippi State Board of Contractors.

C. **Legal Address:** The address appearing on the Proposal Form should be the same address as recorded at the Secretary of State, which should also be the same as at the Mississippi State Board of Contractors.

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:

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 https://www.mid.ms.gov (or most up-to-date link) (No standard form is required for the Bid Bond.) Where bid is to be submitted electronically, a scanned copy of bid bond is acceptable.

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. Where bid is to be submitted electronically, certified check must be physically delivered to the address indicated on the Advertisement for Bids prior to the time and date stated.

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 either submitted electronically via MAGIC or physically delivered to the address indicated on the Advertisement for Bids prior to the time and date stated.

A. **Physical Submittal:** If physically submitted, only one original of Bid Proposal shall be submitted which should be sealed in an opaque envelope marked, mailed or hand-delivered as shown below. If the Bid is mailed, the bid envelope shall be placed inside a second envelope to prevent inadvertent premature opening of the Proposal.

(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)

(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 # GS# 211-071
Title Hayden Hall Renovation
Using Agency Mississippi Gulf Coast Community College
Certificate of Responsibility # _____(for over $50,000.00)
Under $50,000.00 (add statement)

B. **Electronic Submittal:** Bidders must be registered prior to submitting bids electronically. It is the responsibility of the Bidder to allow sufficient time to complete or confirm such registration before the date and time established to receive bids. Information on registration and bidding electronically may be found at www.dfa.ms.gov/dfa-offices/mmrs/mississippi-suppliers-vendors. For further assistance e-mail mash@dfa.ms.gov OR call (601) 359-1343, Option 2. If a Bidder desires to receive system generated Construction Bid Notices for future Bureau of Building, Grounds and Real Property Management opportunities, use Product Code 90922.

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

A. **Physical Bid:** A modification may be written on the outside of the sealed envelope containing the bid.
B. **Electronic Bid:** Information and attachments may be modified and re-submitted via MAGIC.

3.03 **WITHDRAWAL OF BID:** Any bid may be withdrawn prior to the scheduled time for opening of bids. However, after the scheduled opening, bids may not be withdrawn until forty-five (45) calendar 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. Physical Bids without a Certificate of Responsibility on the outside of the envelope, or a statement indicating bid is under $50,000.00, will not be opened. Electronic Bids where Certificate of Responsibility or statement indicating bid is under $50,000.00 is not entered as response to required question, will not be considered.

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.

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 subsequently and promptly provide sufficient documentation with the written request clearly proving an error was made. Failure to provide such documentation adequate to prove an error may result in forfeiture of Bid Security to the Owner.

4.05 **AWARD OF CONTRACT:** The Owner reserves the right to reject any or all bids. A Contract will be awarded (subject to receipt of an executable contract) on the basis of the lowest, responsive, responsible base bid, or lowest combination of base bid and those alternates selected by the Owner generally in the order listed unless a different order is determined to be in the best interest of the Using Agency and/or Owner and which produces a total within available funds. Where such bidder fails to enter into a contract, the Owner reserves the right to award to the next lowest responsive, responsible bidder or resolicit the project.

4.06 **FAILURE TO ENTER INTO A CONTRACT:** The Bidder shall forfeit the Bid Security to the Owner as liquidated damages for any of the following reasons:

A. Prior to award, failure, or refusal, to furnish the names, classifications 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 within three (3) working days after receipt of Notice of Intent to Award the Contract.

B. Prior to award, failure, or refusal, to furnish substitute acceptable Sub-Contractors or entities within five (5) working days of when the Owner or Prime Professional has made reasonable objection to those initially submitted.

C. Following Notice of Award (subject to executable contract), failure, or refusal, to execute and deliver the Form of Agreement Between the Owner and the Contractor, the Performance and Payment Bond, and the Certificate of Insurance within ten (10) working days after receipt of same from the Professional.

4.07 **SECURITY FOR FAITHFUL PERFORMANCE:** 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. 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 00 6100 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), and Surety Seal (preferably embossed). 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 and sealed (preferably embossed ~~seal~~).

PART 5 - BIDDER'S CHECKLIST

The following checklist is for the Bidder's assistance only. It is not inclusive and 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)

Base Bid

( ) Write in the amount of the base bid in words and numbers. In the case of a conflict, the written word shall govern.

Alternates

( ) Write in each alternates amount in words and numbers. In the case of a conflict, the written word shall govern.

Addenda

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

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.msboc.us/Search2.CFM]

( ) 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 MS State Board of Contractors Roster

Certificate of Responsibility Number(s)

( ) Base Bid is under $50,000 and no number is required AND the statement "bid does not exceed $50,000" is on the outside of the sealed envelope or statement included with electronic bid

OR ( ) Base Bid is $50,000 or more and number is required and is on the outside of the sealed envelope or included with electronic bid

( ) 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:**

( ) List any Mechanical, Plumbing, and/or Electrical Sub-Contractors regardless of cost.

* List name even for under $50,000 (see 5.06 regarding COR)
* 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**

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

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

Division 0

PROPOSAL FORM
SECTION 00 4200

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

Re: Project # GS# 211-071
Project Title Hayden Hall Renovation
Location Mississippi Gulf Coast Community College

I propose to complete all work in accordance with the Project Manual and Drawings within 240 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. In case of conflict, the written word governs.)

Words: _____ Dollars
Figures: ($_____)

ALTERNATES: **(**Write in the amount of all of the alternates in words and numbers. In case of conflict, the written word governs.)

Alternate #1 ☐ Adds ☐ Deducts
Words: _____Dollars
($_____)
Description: All upgrades to Courtyard Area

Alternate #2 ☐ Adds ☐ Deducts
Words: _____Dollars
($_____)
Description: All upgrades to Apartment Area

Alternate #3 ☐ Adds ☐ Deducts
Words: _____Dollars
($_____)
Description: All work related to Dumpster Enclosures

Alternate #4 ☐ Adds ☐ Deducts
Words: _____Dollars
($_____)
Description: _____

Alternate #5 ☐ Adds ☐ Deducts
Words: _____Dollars
($_____)
Description: _____

ADDENDA ACKNOWLEDGMENT:

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 _____

Address _____(mailing)

Address _____(physical)

City/State/Zip Code _____County _____

Phone _____ Fax _____ Email _____

■ **BIDDER'S CERTIFICATE OF RESPONSIBILITY NUMBER:** _____

■ **MINORITY BUSINESS ENTERPRISE? (MBE/WBE) Yes ____ No ____** (to assist with Code 57-1-57)

■ Attach copy of Non-Resident Bidder's Preference Law

■ **Mechanical / Plumbing / Electrical Contractors:**

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, regardless of cost even for under $50,000.00. 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 and over $50,000.00, 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.

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

STANDARD FORM OF AGREEMENT BETWEEN THE OWNER AND THE CONTRACTOR
SECTION 00 5200

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 _____ Phone: _____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# 211-071
Hayden Hall Renovation
Mississippi Gulf Coast Community College

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

OWNER: BUREAU OF BUILDING, GROUNDS AND REAL PROPERTY MANAGEMENT

By:_____
(Signature)

_____
(Name and Title)

CONTRACTOR:

By:_____
(Signature)

_____
(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

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 TBD - Advertisement Date

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
AFFIDAVIT OF PAYMENT TO ALL SUBCONTRACTORS
CONDITIONS OF THE CONTRACT
- General Conditions
- Supplementary Conditions
- Labor Requirements
- Minority Participation
- Special Conditions

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

_X_ Division 1: General Requirements	_X_ Division 26: Electrical
_X_ Division 2: Existing Conditions	_X_ Division 27: Communications
_X_ Division 3: Concrete	_X_ Division 28: Electronic Safety and Security
_X_ Division 4: Masonry	_X_ Division 31: Earthwork
_X_ Division 5: Metals	_X_ Division 32: Exterior Improvements
_X_ Division 6: Wood, Plastics and Composites	___ Division 33: Utilities
_X_ Division 7: Thermal and Moisture Protection	___ Division 34: Transportation
_X_ Division 8: Openings	___ Division 35: Waterway and Marine Construction
_X_ Division 9: Finishes	___ Division 40: Process Interconnections
_X_ Division 10: Specialties	___ Division 41: Material Processing and Handling Equipment
___ Division 11: Equipment	___ Division 42: Process Heating, Cooling, and Drying Equipment
_X_ Division 12: Furnishings	___ Division 43: Process Gas and Liquid Handling, Purification, and Storage Equipment
___ Division 13: Special Construction	
___ Division 14: Conveying Equipment	___ Division 44: Pollution and Waste Control Equipment
___ Division 21: Fire Suppression	___ Division 45: Industry-Specific Manufacturing Equipment
_X_ Division 22: Plumbing	___ Division 46: Water and Wastewater Equipment
_X_ Division 23: HVAC	___ Division 48: Electrical Power Generation
___ Division 25: Integrated Automation	

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 TBD - Advertisement Date

Sheets No. _____ through _____	Sheets No. _____ through _____
Sheets No. _____ through _____	Sheets No. _____ through _____
Sheets No. _____ through _____	Sheets No. _____ through _____
Sheets No. _____ through _____	Sheets No. _____ through _____
Sheets No. _____ through _____	Sheets No. _____ through _____
Sheets No. _____ through _____	Sheets No. _____ through _____

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 ___Two Hundred Fifty_____ Dollars ($ __250.00 ___) 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 240 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 PROVISIONS

5.1 **DEFINITION OF TERMS**

5.1.1 Terms used in this Agreement which are defined in the General, Supplementary, and Special 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 Eley Guild Hardy Architects

Address 1091 Tommy Munro Dr. Biloxi, MS 39532

Telephone 228-594-2323 __ Fax Number _N/A ____ E-Mail Address kkish@egh.ms _____

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

Division 0

CONTRACT BOND
SECTION 00 6100

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, Obligee, 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:

_____GS# 211-071_____
_____Hayden Hall Renovation_____
_____Mississippi Gulf Coast Community College_____

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 MS Ins Dept License Number: _____
(Leave blank if you do not have a Mississippi #)

_____
(Surety Address)

_____
(Surety City/State/Zip/Phone)

_____
(MS LICENSED AGENT COMPANY NAME)
(add MS Agent's address below)

COUNTERSIGNED: (if Surety Agent above is NOT MS Licensed)

_____
(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, when signed, can be the same as the Attorney-in-Fact when the Attorney-in-Fact and/or Surety IS licensed in Mississippi. Countersignature will be different when the Attorney-in-Fact and/or Surety 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 Company and/or Agent at MS Ins Dept web:
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.)

CERTIFICATE OF INSURANCE

SECTION 00 6216

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	#
PROJECT: (Number, Name & Location) GS# 211-071 Hayden Hall Renovation Perkinston, MS Mississippi Gulf Coast Community College	**C**	#
	D	#
	E	#
OWNER: Bureau of Building, Grounds & Real Property Management	**F**	#
	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)	

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 Installation Floater	Must be equal to 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) 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 # _____

CERTIFICATE OF INSURANCE INSTRUCTIONS
SECTION 00 6217

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, 2017).

2. The *Certificate of Insurance* must be completed, certified by the original signature of a Mississippi Licensed Insurance Agent and/or countersignature 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 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 MWCC web – You enter the Vendor's name, then click on the policy number to see the MWCC Ins Provider.

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

AFFIDAVIT CERTIFYING PAYMENT TO ALL SUBCONTRACTORS
SECTION 00 6300

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.

Project Number: GS# 211-071

Project Name: Hayden Hall Renovation

Using Agency: Mississippi Gulf Coast Community College

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

Subcontractor: _____ Amount: $_____

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:

_____

GENERAL CONDITIONS
SECTION 00 7200

PART 1 - GENERAL

1.01 **DESCRIPTION**

A. **SCOPE:** The **General Conditions of the Contract for Construction**, AIA Document A201, Seventeenth Edition, 2017, 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 *****

SUPPLEMENTARY CONDITIONS
SECTION 00 7300

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, Seventeenth Edition, 2017. 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**

Change this subparagraph to read as follows:

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and Special Conditions), Drawings, Specifications and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for minor changes in the Work issued by the Prime Professional. The Contract Documents also include the advertisement or invitation for bids or proposals, Instructions to Bidders, and the Contractor's bid or proposal.

1.1.2 **The Contract**

Change each instance of the word "*Architect*" to "*Prime Professional*" and each instance of the word "*Architect's*" to "*Prime Professional's*".

1.1.7 **Instruments of Service**

Change the word "*Architect*" to "*Prime Professional*" and change the word "*Architect's*" to "Prime Professional's".

1.1.8 **Initial Decision Maker**

Change this Subparagraph to read as follows:

The Initial Decision Maker is the person identified as the Professional in Paragraph 5.3.1 of the Standard Form of Agreement Between the Owner and the Contractor and will render initial decisions on Claims in accordance with Section 15.2.

1.1.9 Add a new Subparagraph as follows:

Commissioning Authority Professional
A professional independent of the Prime Professional 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.

1.2.1 Change this Subparagraph to read as follows:

The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor and unless otherwise provided in the Contract Documents, this shall include all labor, materials, equipment, tools, machinery, water, heat, utilities, transportation, and other facilities and services, whether temporary or permanent and whether or not incorporated in the Work. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results. In case of any direct conflict among the Contract Documents, the specifications shall take precedence over the drawings, supplemental or special conditions shall take precedence over more general conditions or requirements, details shall take precedence over plans, and larger scale drawings shall take precedence over smaller scale drawings.

1.5 **Ownership and Use of Drawings, Specifications, and Other Instruments of Service**

1.5.1 Change each instance of the word "*Architect*" to "*Prime Professional*" and each instance of the word "*Architect's*" to "*Prime Professional's*" and 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 separate Agreement Between the Owner and the Professional.

1.5.3 Add a new Subparagraph as follows:

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

1.6 **Notice**

1.6.1 Change this Subparagraph to read as follows:

Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is address and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if transmitted to the government or business issued e-mail address of the respective party.

1.7 **Digital Data Use and Transmission**

Delete the last sentence of this Paragraph.

1.8 **Building Information Models Use and Reliance**

Change this Paragraph to read as follows:

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in a written documents shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

Article 2
OWNER

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 Agreement Between the Owner and the Contractor, his successor in the case of that individual's retirement or termination, or his direct supervisor in the case of that individual's absence. Except as otherwise provided in Subparagraph 4.2.1, the Prime Professional does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

2.1.2 Delete this Subparagraph in its entirety.

2.2 **Evidence of the Owner's Financial Arrangements**

2.2.1 Delete this Subparagraph in its entirety.

2.2.2 Delete this Subparagraph in its entirety.

2.3.1 Delete this Subparagraph in its entirety.

2.2.3 Delete this Subparagraph in its entirety.

2.2.4 Delete this Subparagraph in its entirety.

2.3 **Information and Services Required of the Owner**

2.3.2 Add the word "*or Engineer*" following each instance of the word "*Architect*" and add the words "*or engineering respectively*" following each instance of the word "*architecture*".

2.3.3 Add the word "*or Engineer*" following each instance of the word "*Architect.*

2.3.6 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.

2.4 **Owner's Right to Stop the Work**

Change this Subparagraph to read as follows:

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents as required by Section 12.2 or fails to carry out Work in accordance with the Contract Documents, the Owner may issue, or direct the Prime Professional to issue, a written order to the Contractor to stop the Work or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3. The rights and remedies under this Subparagraph are in addition to and do not in any respect limit any other rights of the Owner, including the right to terminate in accordance with Article 14.

2.5 **Owner's Right to Carry Out the Work**

Change this Paragraph read as follows:

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without predjudice to other remedies the Owner may have, correct such default or neglect. The Prime Professional may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Prime Professional's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Prime Professional, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

Article 3
CONTRACTOR

3.1 **General**

3.1.3 Change the word "*Architect*" to "*Prime Professional*" and change the word "*Architect's*" to "*Prime Professional's*".

3.2 **Review of Contract Documents and Field Conditions by Contractor**

3.2.2 Change each instance of the word "*Architect*" to "*Prime Professional*".

3.2.3 Change each instance of the word "*Architect*" to "*Prime Professional*".

3.2.4 Change the word "*Architect*" to "*Prime Professional*".

3.3 **Supervision and Construction Procedures**

3.3.1 Change each instance of the word "*Architect*" to "*Prime Professional*".

3.4 **Labor and Materials**

3.4.2 Change each instance of the word "*Architect*" to "*Prime Professional*" and add the words "*where such substitution results in a modification of the Contract Sum or Contract Time*" to the end of this sentence.

3.4.4 Add a new Subparagraph as follows:

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:

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

3.4.6 Add a new Subparagraph as follows:

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.

3.5 **Warranty**

3.5.1 Change each instance of the word "*Architect*" to "*Prime Professional*".

3.7 **Permits, Fees, Notices and Compliance with Laws**

3.7.1 Change this Subparagraph to read as follows:

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

3.7.3 Delete the words "*knowing it to be*" from this Subparagraph.

3.7.4 Change each instance of the word "*Architect*" to "*Prime Professional*" and change the word "*Architect's*" to "*Prime Professional's*".

3.7.5 Change the word "*Architect*" to "*Prime Professional*".

3.9 **Superintendent**

3.9.2 Change this Subparagraph to read as follows:

The Contractor, as soon as practicable after award of the Contract, and prior to commencement of any on-site Work, shall notify the Owner and Prime Professional of the name, qualifications and references of the proposed superintendent and any assistant superintendents where provided for in the Contract Documents. Within 14 days of receipt of the information, the Prime Professional shall notify the Contractor stating whether the Owner or the Prime Professional (1) has reasonable objection to the proposed superintendent based upon information provided or other requirements provided for in the Contract Documents or (2) requires additional information or time for review. Failure of the Prime Professional to respond within the 14-day period shall constitute notice of no reasonable objection.

3.9.3 Change the word "*Architect*" to "*Prime Professional*".

3.10 **Contractor's Construction and Submittal Schedules**

3.10.1 Change this Subparagraph to read as follows:

The Contractor, promptly after being awarded the Contract, and no later than fifteen days after the date established in the Notice to Proceed, shall submit for the Owner's and Prime Professional's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed the time limits current under the Contract Documents. Submission of a schedule that indicates or expresses an intent to complete Work prior to the time limits established by the Contract Documents shall not make the Owner liable to the Contractor for any failure to achieve early completion or obligate the Owner to take or prevent any actions to facilitate the Contractor's completion prior to the expiration of the Contract Time. The schedule shall be revised monthly or at more frequent intervals as required by the conditions of the Work and Project.

3.10.2 Change each instance of the word "*Architect's*" to "*Prime Professional's*" and change the word "*Architect*" to "*Prime Professional*".

3.10.3 Change the word "*Architect*" to "*Prime Professional*".

3.11 **Documents and Samples at the Site**

Change each instance of the word "*Architect*" to "*Prime Professional*".

3.12 **Shop Drawings, Product Data and Samples**

3.12.4 Change each instance of the word "*Architect*" to "*Prime Professional*".

3.12.5 Change each instance of the word "*Architect*" to "*Prime Professional*".

3.12.6 Change the word "*Architect*" to "*Prime Professional*".

3.12.7 Change the word "*Architect*" to "*Prime Professional*".

3.12.8 Change each instance of the word "*Architect's*" to "*Prime Professional's*" and change the word "*Architect*" to "*Prime Professional*".

3.12.9 Change the word "*Architect*" to "*Prime Professional*" and change the word "*Architect's*" to "*Prime Professional's*".

3.12.10.1 Change each instance of the word "*Architect*" to "*Prime Professional*".

3.12.10.2 Change each instance of the word "*Architect*" to "*Prime Professional*".

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 assessed to the Contractor.

3.16 **Access to Work**

Change this Paragraph to read as follows:
The Contractor shall provide the Owner, Prime Professional, Commissioning Authority Professional, Separate Contractors and their authorized representatives with access to the Work in preparation and progress wherever located. This shall include the provision of lifts, ladders, scaffolding and/or equivalent for access to elevated work.

3.17 **Royalties, Patents and Copyrights**

Change each instance of the word "*Architect*" to "*Prime Professional*".

3.18 **Indemnification**

3.18.1 Change this Subparagraph to read as follows:

To the fullest extent allowed by law, Contractor shall indemnify, defend, save and hold harmless, protect, and exonerate the Owner, Prime Professional, Prime Professional's consultants, Commissioning Authority Professional, Commissioning Authority Professional's consultants, as well as 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

Change the title of this article from "*ARCHITECT*" to "*PRIME PROFESSIONAL*".

4.1 **General**

4.1.1 Change this Subparagraph to read as follows:

The Prime Professional is the person identified as the Professional in the Agreement Between the Owner and the Contractor and retained by the Owner pursuant to Section 2.3.2.

4.1.2 Change each instance of the word "*Architect*" to "*Prime Professional*".

4.2 **Administration of the Contract**

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

The Prime Professional will provide administration of the Contract as described in the Contract Documents, and will be the Owner's representative during construction until the end of the period for correction of Work as described in Section 12.2.

4.2.2 Change each instance of the word "*Architect*" to "*Prime Professional*".

4.2.3 Change each instance of the word "*Architect*" to "*Prime Professional*".

4.2.4 Change each instance of the word "*Architect*" to "*Prime Professional*" and each instance of the word "*Architect's*" to "*Prime Professional's*".

4.2.5 Change the word "*Architect's*" to "*Prime Professional's*" and change the word "*Architect*" to "*Prime Professional*".

4.2.6 Change each instance of the word "*Architect*" to "*Prime Professional*".

4.2.7 Change each instance of the word "*Architect*" to "*Prime Professional*" and each instance of the word "*Architect's*" to "*Prime Professional's*".

4.2.8 Change each instance of the word "*Architect*" to "*Prime Professional*".

4.2.9 Change the word "*Architect*" to "*Prime Professional*".

4.2.10 Change each instance of the word "*Architect*" to "*Prime Professional*" and the word "*Architect's*" to "*Prime Professional's*".

4.2.11 Change the word "*Architect*" to "*Prime Professional*" and the word "*Architect's*" to "*Prime Professional's*".

4.2.12 Change each instance of the word "*Architect*" to "*Prime Professional*".

4.2.13 Change the word "*Architect's*" to "*Prime Professional's*".

4.2.14 Change each instance of the word "*Architect*" to "*Prime Professional*".

Article 5
SUBCONTRACTORS

5.2 **Award of Subcontracts and Other Contracts for Portions of the Work**

5.2.1 Change this Subparagraph to read as follows:

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 Prime Professional, the names, classifications, 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 as listed on Proposal Form regardless of amount. Within 7 days of receipt of the information, the Prime Professional shall notify the Contractor whether the Owner or the Prime Professional (1) has reasonable objection to any such proposed Sub-Contractor or entity based upon information provided or other requirements provided for in the Contract Documents or (2) requires additional information or time for review. Failure of the Prime Professional to respond within the 7-day period shall constitute notice of no reasonable objection. Where a Project involves a Mississippi Landmark or a building and/or site potentially eligible for such designation, the Contractor shall also furnish documentation that all Sub-Contractors, regardless of Sub-Contract amount, have at least the minimum

number of years of successful experience specified by the Prime Professional in work on previous projects involving State or National Landmarks of similar type, scale and complexity and that all key personnel to be utilized to perform the Work are experienced craftsmen with not less than five (5) years of experience.

5.2.2 Change this Subparagraph to read as follows:

The Contractor shall not contract with a proposed Sub-Contractor or entity to whom the Owner or Prime Professional has made reasonable and timely objection. Other than the Mechanical, Plumbing, or Electrical Sub-Contractors as listed on the Proposal Form, the Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection. Only where the listed Mechanical, Plumbing, or Electrical Sub-Contractor has (1) closed their business (2) entered into bankruptcy or (3) refuses to enter into a contract with the Contractor will substitution of such Sub-Contractor be permitted prior to the execution of the Agreement Between the Owner and Contractor. Substitution for refusal to enter into contract shall not be permitted if the reason for such refusal is due to unilateral reduction by Contractor of such Sub-Contractor's bid price.

5.2.3 Change this Subparagraph to read as follows:

If the Owner or Prime Professional has reasonable objection to a Sub-Contractor or entity proposed by the Contractor, other than the Mechanical, Plumbing, or Electrical Sub-Contractors as listed on the Proposal Form, the Contractor shall propose another to whom the Owner or Prime Professional has no reasonable objection. Neither the Contract Sum nor Contract Time may be increased or decreased due to any change in Sub-Contractor or entity. Failure of Contractor to identify Sub-Contractors or entities to whom the Owner and Prime Professional have no reasonable objections within 10 working days of initial submission shall result in the bid or proposal being deemed non-responsible at which time the Owner may elect to award to the next lowest responsive, responsible bidder or resolicit the project.

5.2.4 Change this Subparagraph to read as follows:

Following the execution of the Agreement Between the Owner and Contractor, the Contractor shall not substitute a Sub-Contractor or entity for one previously selected if the Owner or Prime Professional makes reasonable objection to such substitution. In no case shall substitution of Mechanical, Plumbing or Electrical Sub-Contractors be permitted except where such Sub-Contractor has (1) closed their business (2) entered into bankruptcy (3) becomes in arrears or (4) becomes involved in an ongoing dispute with the Contractor related to the Sub-Contractor's execution, workmanship, or timely performance of their potion of the Work.

Article 6
CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.2.2 Change each instance of the word "*Architect*" to "*Prime Professional*".

6.3 Change the word "*Architect*" to "*Prime Professional*".

Article 7
CHANGES IN THE WORK

7.2 **Change Orders**

7.2.1 Change each instance of the word "*Architect*" to "*Prime Professional*".

7.2.2 Add a new Subparagraph as follows:

The maximum mark-up 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 Sub-Contractors and Sub-Sub-Contractors shall acquiesce to the same requirements when participating in a Change Order.

7.3 **Construction Change Directives**

7.3.4 Change the word "*Architect*" to "*Prime Professional*".

7.3.4.1 Change the word "*Architect*" to "*Prime Professional*".

7.3.6 Change this Subparagraph to read as follows:

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

7.3.7 Change this Subparagraph to read as follows:

A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall become effective once signed by the Prime Professional and the Owner and will subsequently be incorporated into a Change Order.

7.3.8 Change the word "*Architect*" to "*Prime Professional*".

7.3.9 Change this Subparagraph to read as follows:

Until such time that a Construction Change Directive is recorded as a Change Order, the Contractor may not request payment for Work completed under the Construction Change Directive in Applications for Payment.

7.3.10 Change each instance of the word "*Architect*" to "*Prime Professional*".

7.4 Change each instance of the word "*Architect*" to "*Prime Professional*" and the word "*Architect's*" to "*Prime Professional's*".

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.

8.1.3 Change the word "*Architect*" to "*Prime Professional*".

8.2 **Progress and Completion**

8.2.1 Change this Subparagraph to read as follows:

Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work and acknowledges that such period includes time for all applicable submittals, selections, reviews, approvals, inspections, meetings, as well as discovery and investigation of any latent conditions.

8.2.2 Change this Subparagraph to read as follows:

The Contractor shall not knowingly commence the Work prior to the date established in the Notice to Proceed or the effective dates of bond and insurance required to be furnished by the Contractor.

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 (1) an act or neglect of the Owner or Prime Professional, of an employee of either, or of a Separate Contractor; (2) by labor disputes, pandemics, acts of terrorism, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions in excess of any weather days otherwise provided for in the Contract Documents that are documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (3) by delay authorized by the Owner pending dispute resolution; or (4) by other causes that the Contractor asserts, and the Owner, in consultation with the Prime Professional determines justify delay, then the Contract Time shall be extended for such reasonable time as the Owner, in consultation with the Prime Professional, may determine. Such determination shall take into consideration the critical path of the Work and will be reduced by any float in the Contractor's Construction Schedule that does not affect the overall completion of the Work. Except where such delay is due to suspension by the Owner in accordance with Article 14 or such delay has the effect of stopping all progress of the Work for 14 calendar days or more, the Contract Sum will not be increased for additional general overhead expenses; however, it may be increased for direct expenses directly related to the delay of specific portions of the Work so delayed. Any claim for loss or any delay occasioned by any Sub-Contractor or entity under contract with the Contractor, shall be settled between the Contractor and such other Sub-Contractor or entity.

Article 9
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 a schedule of values to the Prime Professional, at least 10 working days before the first Application for Payment, a schedule of values allocating the entire Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Prime Professional. This schedule, unless objected to by the Prime Professional or Owner, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any subsequent changes to the schedule of values shall be submitted to the Prime Professional and supported by such data to substantiate its accuracy as the Prime Professional may require, and unless object to by the Prime Professional or Owner, shall be used as a basis for reviewing the Contractor's subsequent 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:
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 Prime Professional'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 approval of the Owner or Prime Professional in any way.

9.3.2.1 Add a new Clause to Subparagraph 9.3.2 as follows:

Payment in an amount not greater than the documented cost paid by the Contractor for ~~on~~ materials stored at some location other than the Project site, may be approved by the Prime Professional 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 Prime Professional of the materials stored off-site prior to release of payment. Where the storage location is greater than 50 miles of the building site, the Contractor shall pay or reimburse reasonable travel costs of the Prime Professional and/or his Consultants for such review.
.7 Guarantee no storage costs, additional delivery fees, or subsequent costs to the Owner.

9.4 **Applications for Payment**

9.4.1 Change each instance of the word "*Architect*" to "*Prime Professional*" and the word "*Architect's*" to "*Prime Professional's*".

9.4.2 Change each instance of the word "*Architect*" to "*Prime Professional*" and each instance of the word "*Architect's*" to "*Prime Professional's*".

9.5 **Decisions to Withhold Certification**

9.5.1 Change each instance of the word "*Architect*" to "*Prime Professional*" and the word "*Architect's*" to "*Prime Professional's*".

9.5.1.7 Delete the word "*repeated*" from this Clause.

9.5.2 Change the word "*Architect*" to "*Prime Professional*".

9.5.3 Delete this Subparagraph in its entirety.

9.5.4 Change each instance of the word "*Architect*" to "*Prime Professional*".

9.6 **Progress Payments**

9.6.1 Change each instance of the word "*Architect*" to "*Prime Professional*".

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

The Contractor shall pay each Sub-Contractor and material supplier, in accordance with Section 31-5-27 of the Mississippi Code 1972, Annotated, in proportion to the percentage of work completed by each less applicable retainage.

9.6.3 Change each instance of the word "*Architect*" to "*Prime Professional*".

9.6.4 Change the word "*Architect*" to "*Prime Professional*".

9.6.9 Add a new Subparagraph as follows:

The amount retained by the Contractor from each payment to each Sub-Contractor and material supplier shall not exceed the percentage retained by the Owner from the Contractor.

9.6.9.1 Add a new Clause to Subparagraph 9.6.9 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 Prime Professional indicating payments to subcontractors on prior payment request.

9.6.10 Add a new Subparagraph as follows:

The Owner agrees to make payment in accordance with Mississippi Law on "Time for full and final payment to contractors; exemptions; monthly submission by contractors of proof of payment to subcontractors", Section 31-5-25 of the Mississippi Code of 1972, Annotated, which generally provides for payment of undisputed amounts within forty-five (45) days of when they are due and payable. 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.

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:

In order to be considered occupiable or utilizable by the Owner, all life safety systems must be operable and tested and the commissioning requirements for the Work or designated portion thereof must be complete except for thermographs of electrical systems, trend log monitoring, seasonal testing, near-warranty end activities and verification of training sessions.

9.8.3 Change this Subparagraph to read as follows:

Upon receipt of the Contractor's list, the Prime Professional will promptly visit the site to determine whether the Work or designated portion thereof is substantially complete. If, in the opinion of the Prime Professional, the Work or designated portion thereof is not substantially complete, the Prime Professional will not proceed with inspection and the Prime Professional will report the reasons for such determination to the Contractor. In such case, the Contractor shall then submit a revised list and request for inspection when these reasons have been resolved.

9.8.4 Change this Subparagraph to read as follows:

When the Work or designated portion thereof is substantially complete and affirmed by the Owner, the Prime Professional 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 punch list accompanying the Certificate. Unless otherwise provided in the Contract Documents, warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

9.9 **Partial Occupancy or Use**

9.9.1 Change each instance of the word "*Architect*" to "*Prime Professional*".

9.9.2 Change the word "*Architect*" to "*Prime Professional*".

9.10 **Final Completion and Final Payment**

9.10.1 Change this Subparagraph and add the associated Clauses 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 Prime Professional.

1. *Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance by the Owner, the Prime Professional will promptly visit the site and assess the state of the Work to determine if it is ready for final inspection by the Owner. If, in the Prime Professional's judgment, the Work is not ready for final inspection, the Prime Professional will report the reasons for such determination to the Contractor. In such case, the Contractor shall then submit a revised request for final inspection when these reasons have been resolved.*

2. *Once the Prime determines the Work is ready for final inspection, the Prime Professional will call for final inspection of the 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 final punch list furnished to all parties.*
4. *Once corrections of all final punch list items have been confirmed by the Prime Professional, the Prime Professional 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 Prime Professional (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. The final payment will be reduced by the value of any amounts assessed to the Contractor per Section 2.5 Owner's Right to Carry Out the Work, Section 6.3 Owners Right to Clean Up, or Section 9.11 Liquidated Damages where such amounts have not been reconciled by a Change Order per Section 7.2 prior to final acceptance unless such amounts have been resolved via separate agreement(s) between the Owner and the Contractor.

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 be assessed by 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. The Contractor and his Surety acknowledge that losses to the Owner caused by the delay of the Contractor are not readily ascertainable and that the amount estimated per day and established as liquidated damages is reasonable and not a penalty.

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 Sub-Contractor, a Sub-Sub-Contractor, 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. The Contractor may make a Claim for the cost to remedy the damage or loss attributable to acts or omissions of the Owner or Prime Professional and not attributable to the fault or negligence of the Contractor. Where damage or loss is insured under property insurance required by the Contract Documents, the Contractor shall promptly report, file and facilitate the claim process so as to minimize any impacts on the timely completion of the Work. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Paragraph 3.18.

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 Insurance and Bonds**

11.1.1 Add a sentence to the end of this Subparagraph as follows:

Insurance shall be purchased to protect the Contractor from claims set forth below for not less than the limits of liability specified below or required by law, whichever coverage is greater, which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Sub-Contractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

Add new Clauses as follows:

.1 GENERAL LIABILITY:
Commercial General Liability
(Including XCU)

General Aggregate	*$*	*1,000,000.00 Aggregate*
Products & Completed Operations	*$*	*1,000,000.00 Aggregate*
Personal & Advertising Injury	*$*	*500,000.00 Per Occurrence*
Bodily Injury & Property Damage	*$*	*1,000,000.00 Per Occurrence*
Fire Damage Liability	*$*	*50,000.00 Per Occurrence*
Medical Expense	*$*	*5,000.00 Per Person*

.2 OWNERS & CONTRACTORS PROTECTIVE LIABILITY:

Bodily Injury & Property Damage	*$*	*1,000,000.00 Aggregate*
Bodily Injury & Property Damage	*$*	*500,000.00 Per Occurrence*

.3 AUTOMOBILE LIABILITY:
(Owned, Non-owned & Hired Vehicles)
Contractor Insurance Option Number 1:

Bodily Injury & Property Damage	*$*	*500,000.00 Per Occurrence*
(Combined Single Limit)		
Contractor Insurance Option Number 2:		
Bodily Injury	*$*	*250,000.00 Per Person*
Bodily Injury	*$*	*500,000.00 Per Accident*
Property Damage	*$*	*100,000.00 Per Occurrence*

.4 EXCESS LIABILITY:
(Umbrella on projects over $500,000)

Bodily Injury & Property Damage	*$*	*1,000,000.00 Aggregate*
(Combined Single Limit)		

.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*

11.1.5 Add a new Subparagraph to read as follows:

Insurance shall be maintained without interruption from the date of commencement of the Work until the date of final payment unless otherwise noted on the Certificate of Substantial Completion.

11.1.6 Add a new Subparagraph to read as follows:

Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to final execution of the Contract and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. Information concerning reduction of coverage on account of revised limits or clams paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

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.

11.1.8 Add a new Subparagraph as follows:
If any insurance requires deductibles, the Contractor shall pay costs not covered because of such deductibles.

11.1.9 Add a new Subparagraph as follows:

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.

11.2 **Owner's 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.

11.2.1 Delete this Subparagraph in its entirety.

11.2.2 Delete this Subparagraph in its entirety.

11.2.3 Delete this Subparagraph in its entirety.

11.3 **Waivers of Subrogation**

11.3.1 Delete this Subparagraph in its entirety.

11.3.2 Delete this Subparagraph in its entirety.

11.5 **Adjustment and Settlement of Insured Loss**

11.5.1 Delete this Subparagraph in its entirety.

11.5.2 Delete this Subparagraph in its entirety.

Article 12
UNCOVERING AND CORRECTION OF WORK

12.1 **Uncovering of Work**

12.1.1 Change each instance of the word "*Architect's*" to "*Prime Professional's*", change the word "*Architect*" to "*Prime Professional*", and add the words "*or Contract Sum*" at the end of this sentence.

12.1.2 Change each instance of the word "*Architect*" to "*Prime Professional*".

12.2 **Correction of Work**

12.2.1 Change the word "*Architect*" to "*Prime Professional*" and the word "*Architect's*" to "*Prime Professional's*".

12.2.2.1 Change the word "*Architect*" to "*Prime Professional*".

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.

13.3 **Rights and Remedies**

13.3.2 Change the word "*Architect*" to "*Prime Professional*".

13.4 **Tests and Inspections**

13.4.1 Change each instance of the word "*Architect*" to "*Prime Professional and Commissioning Authority Professional*".

13.4.2 Change the first two instances of the word "*Architect*" to "*Prime Professional*" and the second two instances of the word "*Architect*" to "*Prime Professional and Commissioning Authority Professional*".

13.4.3 Change the word "*Architect*" to "*Prime Professional's and Commissioning Authority Professional's*".

13.4.5 Change each instance of the word "*Architect*" to "*Prime Professional and/or the Commissioning Authority Professional*".

13.5 Delete this Paragraph in its entirety.

Article 14
TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 **Termination by the Contractor**

14.1.1.3 Change the word "*Architect*" to "*Prime Professional*".
14.1.1.4 Delete this Clause in its entirety.

14.1.3 Change the word "*Architect*" to "*Prime Professional*".

14.1.4 Change the word "*Architect*" to "*Prime Professional*".

14.2 **Termination by the Owner for Cause**

14.2.1.1 Delete the word "*repeatedly*" from this Clause.

14.2.1.3 Delete the word "*repeatedly*" from this Clause.

14.2.1.3 Delete the word "or" from this Clause.

14.2.1.4 Change the period to a semi-colon and add the word "*or*" to this Clause.

14.2.1.5 Add a new Clause as follows:

fails to achieve Substantial Completion of the Project within the time limits established by the Contract Documents.

14.2.2 Change the word "*Architect*" to "*Prime Professional*" and change the words "*certification by*" to "*advice of*".

14.2.4 Change the word "*Architect's*" to "*Prime Professional's*".

Article 15
CLAIMS AND DISPUTES

15.1 **Claims**

15.1.2 Change this Subparagraph to read as follows:

Commencement of Statutory Limitation Period
The Owner and Contractor shall commence all claims and causes of action within the time period specified by applicable state law.

15.1.3.1 Change each instance of the word "*Architect*" to "*Prime Professional*".

15.1.4 Change this Subparagraph to read as follows:

Where both the Owner and the Contractor concur with the Initial Decision Maker's decision, the Contract Sum and Contract Time shall be adjusted in accordance with Article 7 and the Prime Professional will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

15.1.7 Delete this Subparagraph in its entirety.

15.2 **Initial Decision**

15.2.1 Change this Subparagraph to read as follows:

Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3 and 10.4, shall be referred to the Initial Decision Maker for initial decision. The Prime Professional 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.

15.2.2 Change the words "*approve the Claim*" to "*recommend approval of the Claim to the Owner*".

15.2.4 Change the words "*reject or approve the Claim*" to "*recommend rejection or approval of the Claim to the Owner*".

15.2.5 Change the Subparagraph to read as follows:

The Initial Decision Maker will render an initial decision to recommend approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision recommendation shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Prime Professional, if the Prime Professional is not serving as the Initial Decision Maker, of any recommended change in the Contract Sum or Contract Time or both. Where the Owner concurs with the recommendation it is binding on the parties but subject to arbitration or litigation.

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.

15.3.4 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.

15.4.2 Delete this Subparagraph in its entirety.

15.4.3 Delete this Subparagraph in its entirety.

15.4.4 Delete this Subparagraph in its entirety.

15.4.4.1 Delete this Clause in its entirety.

15.4.4.2 Delete this Clause in its entirety.

15.4.4.3 Delete this Clause 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 and Clauses 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:

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.

MINORITY PARTICIPATION
SECTION 00 7339

PART 1 – PARTICIPATION FORM

1.01 **GENERAL**

The Contractor will submit the following form within seven (7) days from the Notice to Proceed:

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.

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: GS# 211-071 Hayden Hall Renovation

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) forty-eight (48) divisions.

Name: _____

Division: _____

Amount $ _____

Name: _____

Division: _____

Amount $ _____

Name: _____

Division: _____

Amount $ _____

Name: _____

Division: _____

Amount $ _____

Name: _____

Division: _____

Amount $ _____

Name: _____

Division: _____

Amount $ _____

Name: _____

Division: _____

Amount $ _____

Name: _____

Division: _____

Amount $ _____

Name: _____

Division: _____

Amount $ _____

Page 3 of 3 (Submit if necessary)

Name: _____

Division: _____

Amount $ _____

Name: _____

Division: _____

Amount $ _____

Name: _____

Division: _____

Amount $ _____

End of Form

LABOR REQUIREMENTS
SECTION 00 7343

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.

SPECIAL CONDITIONS
SECTION 00 8000

PART 1 - PERFORMANCE INFORMATION

N/A

PART 2 – GRANT CONDITIONS

N/A

PART 3 – OTHER CONDITIONS

N/A

ADDENDA
SECTION 00 9000

1.01 **ADDENDA**

Any Addendum issued on this Project will be included in Section 00 9000 and become a part of the *Standard Form of Agreement Between the Owner and Contractor*.

SUMMARY OF WORK
SECTION 01 1000

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. **Coordination**: The Prime General Contractor is responsible for the coordination of the total project. All other 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 01 3100 entitled *Project Coordination*.

1.02 **CONTRACTS**

Contracts: Construct work under a single Prime General Contract. Refer to Section 00 5200 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 **SPECIAL REQUIREMENTS**

A. Refer to Section 01 8000 entitled *Special Requirements* for any Project specific summary of work requirements.

ALLOWANCES
SECTION 01 2100

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 01 8000 entitled *Special Requirements* for Project specific Schedule of Allowances.

ALTERNATES
SECTION 01 2300

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 01 8000 entitled *Special Requirements* for Project specific description of project Alternates.

CHANGE ORDER PROCEDURES
SECTION 01 2600

1.01 **SCOPE**

A. This Section describes the procedures for processing Change Orders to the Contract by the Owner, the Professional and the Contractor.

1.02 **CHANGE ORDER PROCEDURES**

A. **Change Proposed by Professional**: The Professional may issue a Change Order 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 a Change Order Proposal within ten (10) working 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 01 6000 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 three (3) originals of the Change Order or Change Directive using the Bureau of Building, Grounds and Real Property Management's *Change Order Form*. Where time is of the essence, and at the sole discretion of the Owner, scanned documents may be deemed acceptable to the Owner where signatures and dates are executed in blue ink.

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.
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.

SCHEDULE OF VALUES
SECTION 01 2973

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 2-48. Identify each line item with number and title as listed in Table of Contents in these Specifications.

D. **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. Where determined to be feasible by the Owner, for each line item which has installed value of more than $20,000, break down costs into sub-components or divisions of $20,000 or less, rounding figures to nearest dollar. Make sum of total costs of all items listed in Schedule equal to total Contract Sum.

E. **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.

F. **Review and Resubmittal**: After Professional's review, if requested, revise and resubmit Schedule of Values in same manner.

APPLICATIONS FOR PAYMENT
SECTION 01 2976

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 01 7700 entitled *Contract Closeout.*

C. **Submittal Procedures**:
1. Submit original and one (1) copy of each Application for Payment
2. Submit an updated construction schedule with each Application for Payment as described in Section 01 3216 entitled *Progress Schedule* or Section 01 3127 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.

PROJECT COORDINATION
SECTION 01 3100

1.01 **DESCRIPTION**

A. **Scope**: To set forth procedures, conditions and responsibility for coordination of the total project.

B. **Project Coordinator**: The Contractor, as soon as practicable after the award of each Job Order, and prior to commencement of any on-site Work, shall submit name(s) and qualifications of the proposed superintendent and any assistant superintendents as set forth in the Contract Documents. 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.

C. **Project Manager**: Where a Project involves a Mississippi Landmark or a building and/or site potentially eligible for such designation, the Contractor shall also submit name and qualifications of the project home office project manager as set forth in the General and Supplementary Conditions of the Contract. 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.

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.

PROJECT MEETINGS
SECTION 01 3119

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 to listed attendees 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 listed attendees, regardless of actual participation, 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. **Attendees**:
   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 preliminary 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 01 5000 entitled *Construction Facilities and Temporary Controls* and Section 01 8000 entitled *Special Requirements* 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. **Attendees**:
   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
j. Commissioning issues (if Cx on project)

D. **Commissioning Meetings (if Cx on project)**:
1. The Bureau will schedule a commissioning scoping meeting 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 all Commissioning Meetings.
2. **Attendees:**
   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
3. **Minimum Agenda:**
   a. Review, approve minutes of the previous meeting
   b. Review Issues Log

PROGRESS SCHEDULES
SECTION 01 3216

1.01 **DESCRIPTION**

A. **Scope**: Provide projected construction schedules for the 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 is **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 01 3217

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**.

1.02 **REFERENCES**

A. **Critical Path Methods in Construction Practice, 4th Edition:** Written by James M. Antill and Ronald W. Woodhead, published by Wiley.

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.

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 re-computation 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
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 01 2973.

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.

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 01 3323

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.

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 01 4529

1.01 **DESCRIPTION**

A. **Scope**: The Contractor will employ and pay for the services of an independent laboratory to perform specified services. In some instances, Owner will provide such testing services through independent testing laboratory retained by the Professional. Employment of a testing laboratory or provision of such services by others 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

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 01 5000

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 **International Building Code** [Chapter entitled *Safeguards During Construction*].
2. Refer to Section 00 7200 entitled *General Conditions of the Contract For Construction, Article 10 Protection of Persons and Property* as amended by Section 00 7300 *Supplementary 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 an on-site office with telephone, which may also be used by Subcontractors, the Owner and the Professional. Office location will be approved by the Owner. Where no suitable available space within an existing building is specifically identified for such purposes in Section 01 8000 entitled *Special Requirements* or elsewhere in the Contract Documents, the Prime General Contractor shall provide a trailer with full utilities for such purpose throughout

the Contract Time with space for both Contractor management personnel as well as for holding progress meetings. Each general and individual Contractor shall provide suitable watertight/dampproof sheds or containers to house their construction materials.

D. **Sanitation Facilities**: The Prime General Contractor is responsible for furnishing adequate temporary toilet facilities on the job site unless use of existing facilities on site is specifically permitted in Section 01 8000 entitled *Special Requirements* or elsewhere in the Contract Documents.

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.

F. **Fire Protection**: The Prime General Contractor shall provide general temporary fire protection except where the Work is within an existing building with operational permanent fire protection systems. Subcontractors will be responsible for their own. Where operational permanent fire protection systems exist, the Prime General Contractor and all Subcontractors shall take care not to damage such systems and take measures to prevent accidentally engaging such systems. Where the temporary disabling of any existing operational system is required for the performance of the Work, such shut-down shall be coordinated with the Owner.

G. **Storage**: The Prime General Contractor shall coordinate the allocation of storage areas to the various Subcontractors.

H. **Temporary Heating/Cooling/Dehumidification**: The Prime General Contractor shall provide heating, cooling, dehumidification, fuel and services, as necessary, to protect all work from dampness and cold or excessive heat and humidity until final acceptance. If in the late stages of the construction, mechanical and electrical installations will permit operation without damage to systems, and subject to the approval of the Professional and Owner, the mechanical and electrical facilities may be used to provide heating, cooling, dehumidification and ventilation in strict accordance with conditions established by the Professional and/or his Consultants. However, the Owner is saved harmless of any costs of operation, including the periodic replacement of filters, 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, gas, electricity (lighting and power) and other utilities necessary for construction purposes unless otherwise specified in Section 01 8000 entitled *Special Requirements* or elsewhere in the Contract Documents. Where any such utilities are to be furnished by the Institution or Agency, and such requirements are not detailed in Section 01 8000 or elsewhere in the Contract Documents, a written agreement must be reached on how any such utilities (water, gas, and electricity) will be furnished and the rates the Contractor will be charged by the Institution or Agency prior to initial use of any such utility. 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**: Where required in Section 01 8000 entitled *Special Requirements* or elsewhere in the Contract Documents, the Contractor shall furnish and erect on adequate supports and maintain one (1) neatly constructed sign identifying the names of the Project, Governor, Owner, Prime Professional, Contractor and Using Agency/Institution, and Governing Board as applicable. Sign shall also indicate the source(s) of funds for the project. The erection of additional signs depicting the names of the Contractor, Sub-Contractor, or Vendors is strictly prohibited. Unless a larger sign is otherwise detailed in the Contract Documents, such sign shall be as follows:

1. The Prime General Contractor will erect on adequate supports one (1) neatly constructed and painted or printed four foot by eight foot (4’ x 8’) plywood or equivalent panel conforming to the Owner’s Project Sign Template to be furnished with text, colors, and graphics specific to the Project.
2. No logos, graphics, custom fonts or similar are permitted for Prime Professional or Contractor names depicted on Project Sign.
3. The Prime General Contractor is responsible for maintaining the Project Sign until Final Acceptance of the Work or until Substantial Completion when authorized by the Owner. Any damage, including chipping, pealing or fading of text or images shall be promptly repaired or replaced.

SUBSTITUTIONS AND PRODUCT OPTIONS
SECTION 01 6000

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.
7. Percentage of recovered materials.

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.

B. For products specified by naming a minimum of three (3) products or Manufacturers, select any product and Manufacturer named. Equivalent products of domestic manufacture containing not less than the same percentage of recovered materials as named 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 named product or any product of domestic manufacture containing not less than the same percentage of recovered material as named 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 of domestic manufacture containing not less than the same percentage of recovered materials as named 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 Contact 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.
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.

F. For products where all named products are of domestic manufacture, substitutions of products of foreign manufacture will not be considered unless Contractor can sufficiently document that one or more of the following conditions exist:

1. No product of domestic manufacture meeting the product specifications is readily available that can be provided within the time constraints of the project requirements.
2. Cost to provide a product of domestic manufacture meeting the product specifications is significantly greater than proposed product substitute.

G. Substitutions of products with those of less percentage of recovered material than named product(s) shall only be considered where Contractor can sufficiently document that one or more of the following conditions exist:

1. No product of equal or greater percentage of recovered material as named product(s) is available that can be provided within the time constraints of the project requirements.
2. Cost to provide a product of equal or greater percentage of recovered material as named product(s) meeting the product specifications is significantly greater than that of named product(s).

CUTTING AND PATCHING
SECTION 01 7329

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.

CLEANING
SECTION 01 7400

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.

STARTING OF SYSTEMS
SECTION 01 7500

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 01 7700

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.

1.02 **FINAL INSPECTIONS**

A. **Professional's Review**: The Contractor shall make written notice that the Work of a Job Order is ready for final inspection and acceptance by the Owner to the Professional; such notice to be given not less than ten (10) days prior to the date desired for inspection. The Professional will promptly visit the site and assess the state of Work of the Job Order to determine if it is ready for final inspection by the Owner. If, in the Professional's judgment, the Work of the Job Order is not ready for final inspection, the Professional will report the reasons for such determination to the Contractor. In such case, the Contractor shall then submit a revised request for final inspection when those reasons have been resolved. Once the Professional determines the Work of the Job Order is ready for final inspection, the Prime Professional will call for final inspection of the Project with the Owner for the purpose of determining whether the Work of the Job Order is acceptable under the Contract Documents.

B. **Owner's Inspection**: After the Professional has ascertained the Work of the Job Order to be ready, an Owner's inspection will be scheduled within ten (10) days thereafter. The Contractor will have not more than thirty (30) days thereafter, unless a longer time for specific items is mutually agreed to in writing by the Owner and Contractor to make any corrections of the final punch list items and to submit closeout documents.

C. **Correction of Work Before Final Payment**: The Contractor shall address all defects or discrepancies noted on the final punch list and 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 or discrepancies after thirty (30) days, unless a longer time for specific items is mutually agreed to in writing by the Owner and Contractor, 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.

1.03 **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.

G. **Project Record Documents**: Furnish all other record documents as set forth in Section 01 7800 entitled *Project Record Documents*. Failure provide such documents within thirty (30) days of Request for Final Payment shall result in the Owner, in consultation with the Professional, determining a fair market value of such documents with such costs to be retained or deducted from the balance due the Contractor, or charged to the Contractor in the event no payment is due.

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. Failure provide such documents within thirty (30) days of Request for Final Payment shall result in the Owner, in consultation with the Professional, determining a fair market value of such documents with such costs shall be deducted from the balance due the Contractor, or charged to the Contractor in the event no payment is due.

PROJECT RECORD DOCUMENTS
SECTION 01 7800

1.01 **DESCRIPTION**

A. **Scope**: To set forth the procedure and requirements for keeping project record documents.

B. **Maintenance Documents**:

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.
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.

SPECIAL REQUIREMENTS
SECTION 01 8000

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. Base Bid and Alternates may be worked on at same time
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 as follows: N/A

B. Owner will occupy the following areas throughout the Project or during portions of the Project as follows: Exterior parking areas, Apartment (if alternate is not accepted)

C. Prior to occupancy of any portion of the Project, a *Certificate of Substantial Completion* for designated areas shall be executed establishing responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance for such portion of the Work.

PART 2 - ALLOWANCE SUPPLEMENT

2.01 **SCHEDULE OF ALLOWANCES**

A. Include in the Bid, for inclusion in the Contract Sum, the amount of $ 20,000.00 for purchase of Mechanical Controls
(Refer to Section 23 09 00, Controls and Instrumentation)

B. Include in the Bid, for inclusion in the Contract Sum, the amount of $ N/A for purchase of _____
(Refer to Section _____, _____)

PART 3 - ALTERNATE SUPPLEMENT

3.01 **DESCRIPTION OF ALTERNATES**

A. Alternate Number One. All upgrades to Courtyard Area

B. Alternate Number Two. All upgrades to Apartment Area

C. Alternate Number Three. All Work related to Dumpster Enclosures

D. Alternate Number Four.

E. Alternate Number Five.

PART 4 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS SUPPLEMENT

SITE LAYOUT PLAN

Provide site layout plan for MGCCC approval indicating the following:

Fence layout plan
Ingress and egress from site
Dumpster locations
Field office
Toilets
Employee parking

FIELD OFFICE

The field office per Section 01 5000 – Construction Facilities and Temporary Controls, shall be open at all times work is being performed. All submittals and shop drawings shall be placed in this location for review by any party.

The following shall be provided within the field office and equipped with the following:

Heating and Air Conditioning
Telephone
Broadband Wireless Internet Connection (access by all parties involved)
Power receptacles
Photocopier
Coffee and Water Beverage Service
Conference Room for a minimum 8 persons.
Large screen TV (42" minimum) with connectivity for meetings and presentations.
Restroom facilities (minimum 2)

UTILITIES

The Contractor shall make all temporary connections to MGCCC utility systems as required for construction purposes. They shall also disconnect and return to original condition upon completion. Lighting shall be of adequate intensity and quality for proper prosecution and inspection of work being performed.

PROJECT SIGN

Provide project sign per Section 01 5000 – Construction Facilities and Temporary Controls. The erection of additional signs depicting the names of the Contractor, Sub-Contractor, or Vendors is strictly prohibited.

JOB SITE SECURITY

Contractor shall erect security fences around construction and storage areas to prevent the public from entering the construction areas while work is occurring. The security fence shall consist of 6'-0" high temporary construction chain link fence, anchored into existing asphalt (temporary on-grade bases are not allowed) with black windscreen (minimum 80% blockage – no logos) installed to restrict viewing of the Project site. Provide OSHA compliant pedestrian and vehicular job site access shall be provided for access to the project site.

TEMPORARY EXTERIOR ENCLOSURES

Construction temporary enclosures where facility will be exposed to the elements for more than 12 hours once interior finishes (wood doors, gypsum board, flooring, etc) is being performed. Minimum construction for temporary enclosures shall be 2" x 4" wood studs @ 24" oc, insulated, with 1-layer fire resistant 5/8" plywood on one side and 10 mil visqueen on other. Seal all joints and perimeter.

Equip partitions with gasketed dustproof doors and security locks where openings are required.

TEMPORARY HVAC

It is the responsibility of the Contractor to maintain consistent temperature and humidity levels one finishing activities proceed in the buildings.

Room temperature: 55-85 degrees Fahrenheit

Room relative humidity: 35%-65% preferred but maintaining a 15% fluctuation between highest and lowest average is acceptable.

Record temperature and humidity every day. Take base line readings for high/low humidity average, and temperature average prior to any construction. Submit documentation with monthly pay application.

Use of the new HVAC units is allowed, but warranties will not start until the date of Substantial Completion. Filters are required to be changed at once a week minimum. Coils and ductwork will be inspected and be required to be cleaned if found to be excessively dirty due to not changing out the filters at Substantial Completion.

Additional commercial dehumidifiers or other equipment may be required to maintain these conditions. This cost shall be included in the Base Bid.

PART 5 – ANTICIPATED DELAYS

ADVERSE WEATHER

In reference to AIA 201, Article 15.1.6, add the following terms and conditions:

A. The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the Project location and will constitute the base line for monthly weather time evaluations. The Contractor's activity durations in the progress schedule must reflect these anticipated adverse weather delays in all-weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAYS
BASED ON FIVE (5) DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
(6)	(9)	(9)	(9)	(5)	(5)	(5)	(7)	(4)	(4)	(4)	(7)

B. Upon receipt of the Notice to Proceed (NTP) and continuing throughout the contract, the Contractor shall record on the daily report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on the overall project's critical activities for 50 percent or more of the contractor's schedule work day and register .10 inches of rain or more. The number of actual adverse weather days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated above, the Owner and Architect will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather days and issue a modification in accordance with the contract.

C. The Contractor must submit each month with his application for payment a separate letter stating that he is requesting an extension of time for abnormal adverse weather or that he has no claim for an extension for that period of time. No payment on a monthly application is due until the letter is received. Complete justification including an analysis verifying that conditions as stated herein above must accompany each request. A Contractor's letter or statement that it was delayed will not be considered as adequate justification. The receipt of this request and data by the Architect will not be considered as Owner and Architect approval of a time extension in any way.

PART 6 – INSTITUTION/AGENCY REQUIREMENTS

PROHIBITED ACTIVITIES

No tobacco use or vaping on campus.
No contact with students or staff no assigned to the Project.
No weapons, drugs, or alcohol allowed on campus.

USE OF PREMISES

Housekeeping / Security procedures:

Daily clean-up is required.
Work areas are to be locked when possible.
Do not leave keys in equipment on site.
Contact 911 for emergencies, then also call campus police.
MGCCC Perkinston Campus Police phone number: 601-928-6327

MGCCC Additional Requirements

Notifications are required for utility interruptions; minimum 48-hour notice is required.

Protect surroundings from damage during the project.

The Contractor should contact campus police to let them know of work planned during closed campus times.

Dates for events and class schedules available on the MGCCC website. MGCCC football plays on Thursdays. Stone High football games are held on Fridays. Secure site to prevent parking during these times inside work areas.

Football Homecoming and the Festival of Lights dates are to be determined (no work on these days, ensure all areas are clean and secured prior to).

SECTION 019100 – GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Commissioning requirements common to all Sections.

B. Systems and equipment ‘Start-Up’ and ‘Functional Performance Testing’.

C. Validation of proper and thorough installation of systems and equipment.

D. Equipment performance verification.

E. Documentation of tests, procedures, and installations.

F. Coordination and requirements of ‘Training Events’.

G. Preparation and logistics of Systems Manual content.

H. Management of record construction documentation.

1.02 GENERAL DESCRIPTION

A. Commissioning (Cx) is the process of ensuring that (i) all building systems are installed and perform interactively according to the design intent; (ii) that systems are efficient and cost effective and meet the Owner’s operational needs; (iii) that the installation is accurately documented; and (iv) that the Operators are adequately trained. Commissioning serves as a tool to minimize post- occupancy operational problems, and establishes testing and communication protocols to advance the building systems from installation to optimized, fully dynamic operation.

B. Commissioning Authority (CA) shall work with the Contractor and the design engineers to direct and oversee the Cx process and perform Functional Performance Testing.

C. The Commissioning Plan outlines the Cx process beyond the Construction Contract, including design phase activities and design team/Owner responsibilities. The specification Sections dictate all requirements of the commissioning process relative to the construction contract. The Cx Plan is not part of the construction contract, although it is available for reference at the request of the Contractor.

D. This Section and other sections of the specification details the Contractor’s responsibilities relative to the Cx process. It expands on the Cx Plan, which covers the roles and responsibilities of Parties outside of the construction contract.

1.03 SCOPE

A. This Section covers elements, requirements, procedures, and protocols common across all Divisions of the work. Requirements specific to individual Sections are generally specified in the technical specification as well as a dedicated Section for each of Divisions 22, 23, 25, and 26.

B. Specific systems to be commissioned are indicated in the following Divisions of the Specification:

1. Division 01 - Building Envelope: Requirements for Cx are specified in Section 019119.
2. Divisions 02–12, 14: Conformance to the following provisions of the Cx requirements is required under Division 01 and this Section:

    a. Equipment and Systems Training as required by individual Sections.
    b. Systems Manual preparation and maintenance.
    c. Record Document preparation and maintenance.

3. Division 22 – Plumbing: Requirements for Cx are specified in Section 220800 as well as in individual Division 22 Sections.
4. Division 23 - HVAC: Requirements for Cx are specified in Section 230800 as well as in individual Division 23 Sections.
5. Division 26 – Electrical: Requirements for Cx are specified in Section 260800 as well as in individual Division 26 Sections.

1.04 RELATED WORK AND DOCUMENTS

A. Commissioning Plan: The Cx Plan outlines responsibilities outside of the construction contract and shall be available to all Parties for reference. It gives the Contractor a perspective with respect to the overall process. It encompasses the entire Cx process including design phase and post construction tasks.

B. The Cx process references many related Sections, particularly Section 019100 - General Commissioning Requirements. It is important for all Contractors subject to the Cx process to be familiar with Section 019100.

C. Section 019110 – General Commissioning Requirements for Functional Performance Testing.

D. Section 220800 – Plumbing System Commissioning.

E. Section 260800 – Electrical Systems Commissioning.

F. Individual Specification Sections: Individual Sections stipulate installation, start-up, warranty, O&M documentation, and training requirements for the system or device specified in the Section.

1.05 DEFINITIONS AND ABBREVIATIONS

A. Acceptance Phase: This is the phase of the project when the facility and its systems and equipment are inspected, tested, verified, and documented; and when most of the Functional Performance Testing and final training occurs. This will generally occur after the Construction Phase is complete (after Start-Up Documentation have been completed). The Acceptance Phase begins upon System 'Turn-Over' with certification by the Contractor that the systems have been placed into service in accordance with the approved protocols and after the submission of the approved Start-Up Documentation. The Acceptance Phase ends with the successful completion of all Functional Performance Testing and sign-off by the CA.

B. Action Item (AI): Any Cx-related issue that requires a response, completion, corrective or additional work, or any other action. Examples include a Request for Information (RFI), a work directive, a clarification request, a to-do item, an identified deficiency, or any other like item. Action Items must be categorized as appropriate.

C. Action List: This is a list that is maintained and updated by the CA that includes all Action Items that relate to Cx activities.

D. Activation: The process of relocating the occupants; fitting out the furniture, furnishings, and equipment (FF&E); and generally ensuring a smooth occupant transition.

E. A/E: General reference to the Architect/Engineer lead-design entity.

F. ASHRAE: American Society of Heating, Refrigerating, and Air Conditioning Engineers.

G. Basis of Design (BOD) Document: The Basis of Design document is developed by the design team, and shall respond to and be consistent with the performance criteria specified in the Owner's Project Requirements. The BOD illustrates the means by which the OPR criteria are to be achieved, documenting the assumptions and parameters used in the design, and documenting the primary thought processes or decisions made that resulted in the selected alternatives. At the end of the project, the final BOD content may be incorporated into the Systems Manual if desired in part or in its entirety. The BOD is a required component for LEED- certified projects, and is recommended by ASHRAE for all projects subject to the Cx process.

H. Building Automation System (BAS): The computer-based control or automation system. BAS is used throughout these Sections. Alternate references common in the industry include facility management system, automatic temperature control system, direct digital control system, building management system, building management and control system, digital control system, Energy Management System, Energy Management and Control System or System Control and Data Acquisition (SCADA) System.

I. Building Automation System Sub-System: This is a special case of the BAS definition presented earlier. These systems are representative of all control systems that must integrate with or be connected to the primary BAS infrastructure in the project. Division 25 covers all requirements for BAS Sub-Systems requirements in relation to the BAS. These sub-systems may be defined in many Sections.

J. Building Enclosure Commissioning Authority (BECxA): The Party retained by the Owner will oversee the BECx process, develop and stipulate many of the BECx requirements, manage the BECx process, and validate that building enclosure systems are designed, installed, and tested to meet the Owner's requirements and/or contract documents provided by the Architect-of- Record.

K. Building Enclosure Commissioning (BECx): The process of facilitating the quality installation of the building enclosure materials, components, and systems in accordance with the contract documents and satisfy the requirements of the Building Enclosure Design Intent.

L. Building Enclosure Commissioning Coordinator (BECxC): This refers to the Individual that is designated the POC for BECx activities.

M. Checklist Item: An item to inspect to verify proper installation of equipment or systems by the Contractor. Checklist items simply require a 'Yes/No' or 'OK/Not' response. Start-Up Checklist items are one component of the Start-Up Documentation.

N. CMMS: Computerized Maintenance Management System.

O. Commissioning (Cx): The process of ensuring that all building systems perform interactively according to the design intent, that the systems are efficient and cost effective, and that they meet the Owner's operational needs.

P. Commissioning Authority (CA): The Party retained by the Owner who will oversee and manage the Cx process, develop and stipulate many of the Cx requirements, and ensure and validate that systems and equipment are designed, installed, and tested to meet the Owner's requirements.

Q. Commissioning Coordinator (CxC): This refers to the Individual within each of the various Parties that is designated the POC for that Party relative to Cx activities. Each of the Contractors subject to the Cx process should designate a CxC and make that person available to the CA as the point-of-contact for that Contractor.

R. Cx Record Matrix: The Cx Record Matrix provides an ongoing and updated status of the Cx program as it is being executed. It is a table of all systems and equipment subject to the Cx process and the status and responsible party of Cx procedures relating to that equipment. Typical fields tracked include equipment tag, location, description, Start-Up Documentation status, FPT status, training status, status of submittals and record drawings, and final Cx disposition.

S. Commissioning Specifications: Generic reference to any of the Cx-specific specification Sections, as inferred by the usage. Divisions 01, 22, 23, 26, and others contain Sections that are specific to or reference the Cx process. All Contractor requirements relating to Cx should be conveyed within the Cx Specs. Cx Specs should be referenced but not duplicated within the Cx Plan (the Cx Plan is designed to govern non-Contractor-related Cx issues).

T. Commissioning Team (CxT): The group of Parties involved in the Cx process for any given system. The Cx Team will include a core group involved with all systems, consisting of the CA and CxC members representing the CM and the Owner. On any given system, the Cx Team will additionally include the CxC's for the Contractors responsible for the system or equipment.

U. Contractor: As used herein, 'Contractor' is a general reference to the installing Party or the Parties that hired installing Parties and can therefore refer to the CM, subcontractors, or vendors as inferred by its usage.

V. Construction Manager (CM): The Party acting as the primary coordinator of all the major subcontractors (MC, EC, TAB, BAC, etc.) as applicable.

W. Construction Phase: Phase of the project during which the facility is constructed and/or when systems and equipment are installed and started. Contractor and subcontractors complete the installation, complete Start-Up Documentation, submit O&M information, establish trends, and perform any other applicable requirements to make systems operational. Contractor and Vendors may also conduct 'Equipment and Systems Training' events during this phase. The Construction Phase concludes upon completed Start-Up and TAB of systems and equipment.

X. Contract Documents: The documents governing the responsibilities and relationships between Parties involved in the design and construction of this project including (but not necessarily limited to):

1. Agreements/Contracts.
2. Construction Plans and Drawings.
3. Specifications.
4. Addenda.
5. Change Orders.
6. Commissioning Plan (for reference only).

Y. Construction Documents: Refers generally to the Contract Documents that dictate the details of the installation (all but item 1. above).

Z. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents, does not perform properly or is not complying with the design intent.

AA. Design Engineer: Generic reference to the engineer-of-record or a specific engineering disciple as inferred by its usage.

BB. Design Intent Document (DID): Outdated term that is synonymous with Owner's Project Requirements (see below).

CC. Electrical Contractor (EC): Contractor generally responsible for Division 26 work.

DD. Factory-Authorized Representative: An individual fully trained on the equipment and certified by the manufacturer to perform the respective task.

EE. Factory Testing: Testing of equipment off-site at the manufacturer's facility. May be witnessed by the members of the project team.

FF. FF&E: Furniture, Furnishing, and Equipment. This term is used to refer to the generally movable fit-out elements of a building that are not included in the construction contract but are dealt with in the Activation.

GG. Fire Alarm Contractor (FAC): Contractor generally responsible for the fire alarm system installation.

HH. Fire Suppression Contractor (FSC): Contractor generally responsible for the installation of the fire suppression system (sprinkler, standpipe, and fire pump).

II. Fixed Construction: Elements of the building that are built in. This term is typically used in contrast to FF&E.

JJ. Functional Completion: A Cx program milestone that marks the successful completion of the FPTs by the CA and therefore completion of the Acceptance Phase. Functional Completion is a prerequisite for Substantial Completion.

KK. Functional Performance Tests/Testing (FPT): The detailed and thorough tests (and test procedure) developed and performed by the CA to document proper operation of building systems and the components and equipment making up those systems during the Acceptance Phase. References made to FPT throughout the documents are inclusive of ISFPT unless specifically indicated otherwise.

LL. General Contractor (GC): The prime contractor hired to execute the construction project. Generally, this contractor would hold the contracts for the majority of sub-contractors on the project.

MM. IAQ: Indoor Air Quality.

NN. Interactive System Functional Performance Testing (ISFPT): The detailed and thorough testing of the interactions of various systems in the building. ISFPTs are considered a subset of the overall concept of FPT and therefore references made to FPT generally will include ISFPTs unless specifically indicated otherwise.

OO. Laboratory Controls Contractor (LCC): Contractor generally responsible for Laboratory control systems and components.

PP. Manufacturer's Representative: Either an individual in direct employ of the manufacturer of the applicable system, or an individual who is certified by that manufacturer to perform the applicable work for which the reference is made. This is synonymous with Factory-Authorized Representative.

QQ. Mechanical Contractor (MC): Contractor generally responsible for Division 21-25 work.

RR. O&M Documentation: Contractor-developed documentation designed to address the needs of facilities personnel and customized for the context of the specific facility and installation. The foundation of O&M Documentation is manufacturer's literature (O&M Manuals), with additional Contractor-developed step-by-step instructions for manual start/stop, emergency procedures, operating sequences, preventative maintenance, and other installation-specific information. O&M Documentation content is indexed/organized by equipment-type. When a Systems Manual is being developed by the CA, some of the Contractor-developed content will need to be made available to the CA for inclusion into the Systems Manual.

SS. O&M Manuals: Generic reference to manufacturer-published O&M materials, which have no information specific to the facility, but may be edited or marked up to indicate specific equipment or systems installed. O&M Manuals include documents covering installation, operation, maintenance, troubleshooting guides, parts numbers, engineering and design parameters, applications manuals, and any/all information available from the manufacturer pertaining to the installed equipment or systems. Specifications should strive for this information to be submitted in electronic form whenever possible. The electronic versions of these documents can also be electronically edited to indicate equipment installed and to delete or mask-over equipment and content that is not installed on the project.

TT. Observation Period (BAS): Period of time either prior to or immediately following Functional Performance Testing where the BAS is shown to operate properly without malfunction, without alarm caused by control action or device failure, and with smooth and stable control of systems and equipment in conformance with these specifications.

UU. Opposite Season: The season opposite that when the majority of the functional performance testing occurs.

VV. Owner (Owner): Party acting as the Owner's designated representative for the project. The Owner is responsible for managing the entire project and to act as the Owner in all design and construction-related issues. Generally, the Owner will include multiple personnel such as the Project Manager, Field Manager, and MEP Project Engineer.

WW. Owner's Project Requirements (OPR): The OPR is intended to provide the basis from which all design, construction, acceptance, and operational decisions are made. It details the functional requirements of the project, including systems subject to commissioning. The OPR defines the benchmarks and metrics by which the success of the project is ultimately judged, and evolves through each project Phase. The OPR is typically developed early in the project cycle by the Owner and the A/E and provides the user needs, requirements, goals, and metrics that are defined by the Owner to be important. The OPR criteria are referenced by and should be the foundation of the BOD narrative. At the end of the project, the content of final OPR and BOD may be incorporated into the Systems Manual. The OPR and BOD are a required component for LEED-certified projects, and is recommended for all projects subject to the Cx process.

XX. Party: Entity (company, corporation, etc.) legally responsible for portion of work.

YY. Point-of-Contact (POC): General reference to a key individual within each Party.

ZZ. Prefunctional: The term “Prefunctional” is synonymous with “Start-Up”, but not used in these specifications. It is a modifier for checks, tests, and other activities that occur prior to and are prerequisites for Functional Performance Testing.

AAA. Preliminary Service: Refers to initial operation of a system or piece of equipment to provide temporary service where initial Start-Up to determine safe operation has been performed. Final TAB and Functional Performance Testing proceeds while the system is in Preliminary Service.

BBB. Pre-Test: Preliminary testing accomplished to verify system functionality prior to placing the system/equipment into Preliminary Service.

CCC. Project Phases: Phases of the project include the Construction Phase, Acceptance Phase, Warranty Phase. Earlier Phases include Program Phase and Design Phase.

DDD. RFI: Request for Information.

EEE. Scheduled Outage: A period of time, scheduled by Owner, in which the system is out-of- service or not to be used by occupants.

FFF. Security System Contractor (SSC): Contractor responsible for the installation of the Security Systems.

GGG. Start-Up: Refers to the quality control procedures whereby the Contractor verifies the proper installation of a device or piece of equipment, executes the manufacturer's starting procedures, completes the ‘Start-Up Checklist’, energizes the device, verifies that it is in proper working order and ready for dynamic testing, and completes the ‘Start-Up Tests’. Start-Up procedures are performed by the Contractor with or without a formal Cx process, although the documentation is more formalized when the Cx process is used.

HHH. Start-Up Checklist: A list of items to inspect to verify proper installation of equipment or systems by the Contractor. Checklist items simply require a ‘Yes/No’ or ‘OK/Not’ response. These include primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension checked oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). Start-Up Checklist items are one component of the Start-Up Documentation (Start-Up Tests being the other).

III. Start-Up Documentation: Refers to the combination of Start-Up Checklists + Start-Up Tests. The Contractor documents the Start-Up procedure by completing and submitting the Start-Up Documentation. Start-Up Documentation may be a combination of procedures prepared by the Contractor and/or the CA, those included in the Contractors in-house quality assurance process, and those required by the manufacturer start-up procedures. Regardless of the context of the checklist or format of the form used to document it, the reference to ‘Start-Up Documentation’ includes all of the stated checklists and tests.

JJJ. Start-Up Test: This is a quality-assurance test that is required to ensure the system is ready to be placed into service. It differs from a checklist item in that it requires more than a binary (yes/no, OK/Not OK) response. It is an observation, measurement, or sequence of events that must be documented. Start-Up Tests are one component of the Start-Up Documentation (Start-Up Checklists being the other).

KKK. Substantial Completion: Milestone as defined in the Owner-Contractor agreement and Specifications. This milestone also coincides with the start of the Warranty Period.

LLL. System Turn-Over Meeting (“STOM”): Turn-Over is a quality control milestone in which all Contractors responsible for completing the installation and start-up of a system or equipment, along

with the Owner and CM, meet to validate that the system or equipment is completed and operational per the contract documents and ready for Functional Performance Testing, and that all the Start-Up Documentation and nameplate data is complete and accurate. The CA will in many cases participate in this. CM shall organize and lead the process in all cases.

MMM. Systems Manual: The Systems Manual is the final deliverable from the Cx process, and provides the information needed to understand, operate, and maintain the facility and its systems. It is typically developed by the CA or A/E, but with content required to be provided by the design team and the Contractors. The Systems Manual expands the scope of standard O&M documentation to incorporate additional information developed through the Cx process. The Systems Manual should be the repository of all updates and corrections as they occur (even throughout Occupancy). It is narrative in nature and organized by system types and by area/usage of the facility (if applicable). Systems Manual content typically includes narrative descriptions of the facility and systems, sequences of operation, schematic diagrams, cuts from design drawings and equipment literature, photos, and manual start/stop and emergency operating procedures for important equipment. The content of the Systems Manual is dictated by budget, and usually consists of a single narrative document with references to and inclusive of the entire set of O&M and Training materials.

NNN. Systems Matrix: A table that lists systems and equipment as individual rows (typically using the specifications sections as a guide) and columns that indicate different tasks, documentation, and work elements. The content of the cells of the matrix summarizes the requirement for system as it relates to that column. It provides and effective summary of requirements that is approved by the Owner and operator representatives during design phase.

OOO. Test: A task, procedure or measurement that confirms capacity, functionality, accuracy, etc. Tests can have only 1 state at any given time; “Pass”, “Fail”, “Couldn’t Test” or “Didn’t Test”. May refer to Start-Up or Functional Performance Tests.

PPP. TAB: Can refer to the test, adjust, and balance process or the Testing, Adjusting, and Balancing Contractor as inferred by its usage.

QQQ. Temporary Conditioning Plan: A plan that summarizes the logistics, procedures, and protocols for taking permanent equipment and using it to maintain conditions throughout construction. The Temporary Conditioning Plan must be approved by all members of the Cx Team prior to placing equipment into temporary service.

RRR. Testing Agency: An independent agency typically retained by the Contractor to perform specialized testing of systems or equipment (most commonly electrical). The Testing Agency shall be qualified and equipped to perform the testing and shall submit appropriate qualifications.

SSS. Trending: Monitoring and recording a history of parameters typically using the building automation system.

TTT. Vendor: Refers to the organization that sold a system or equipment to the subcontractor. This may be a branch office of the manufacturer or a value-added reseller.

UUU. Warranty Period: The period defined by the construction documents where elements of the facility are under contractual warranty.

VVV. Warranty Phase: Includes the early occupancy of the building and can continue through the contractual Warranty Period and at least into the opposite season from when the facility systems were initially tested.

1.06 REFERENCE STANDARDS

A. ASHRAE Standard 202 – Commissioning Process for Buildings and Systems.

B. ASHRAE Guideline 0 – The Commissioning Process.

C. ASHRAE Guideline 1.1 – HVAC&R Technical Requirements for the Commissioning Process.

D. ASHRAE Guideline 1.3 – Building Operations and Maintenance Training for the HVAC&R Commissioning Process.

E. ASHRAE Guideline 1.4 – Procedures for Preparing Facility Systems Manual.

F. NEBB – Procedural Standards for Building Systems Commissioning.

G. SMACNA IAQ Guidelines for Occupied Buildings Under Construction.

1.07 DOCUMENTATION

A. Contractor shall provide the following documentation to the CA per the procedures specified herein and in other Sections of the specification.

1. Shop Drawings and Product Data: CA shall be provided shop drawings and submittal data for systems and equipment that will be part of the Cx process. Some of these submittals will be reviewed by the CA and others are only needed for record. CA will mark up the Submittal Register to indicate the documents required. Electronic format shall be in PDF format and shall be capable of allowing electronic comments and markups.

    a. Submittals to be Reviewed: CM shall provide the CA one electronic copy of Shop Drawings and Product Data concurrent with distribution to the A/E. CA shall review and incorporate comments via the A/E. CM shall then copy CA with the final reviewed submittal with A/E approval stamp.
    b. Submittals for Record: CM shall provide to the CA the final electronic record copy of the submittal.

2. Factory Test Reports: Contractor shall provide any factory testing documentation or certified test reports required by the specifications. These shall be provided prior to Acceptance Phase.
3. Schedule Updates: Issue periodic updates to the construction schedule as specified. Provide electronic copy of each update to the CA. Contractor shall use schedule updates to notify Cx Team of scheduled start-up and training activities.
4. Temporary Operating and Conditioning Plan: Contractor shall provide initial Temporary Operating and Conditioning Plan for approval and then issue periodic updates to reflect actual conditions. At the completion of the temporary conditioning period, the final plan shall be submitted with completed maintenance records, inspection and check logs, operating logs, and narrative of any problems or issues that occurred during Temporary Conditioning (if applicable).
5. Piping Cleaning, Flush, and Fill Plan: Contractor shall provide Piping Cleaning, Flush, and Fill Plan for approval at least 30 days prior to final cleaning, flush, and fill.
6. Action Item Response: Respond to Action Items to which the CA assigns responsibility to the Contractor.
7. Field Testing Agency Reports. Provide all documentation of work of independent testing agencies required by the specification. These shall be provided prior to Acceptance Phase.

8. Completed Start-Up Documentation: Provide completed Start-Up Documentation for all applicable equipment and systems. Provide prior to the start of the Acceptance Phase. CA will review prior to FPT.
9. Nameplate Data Documentation: Provide prior to the start of the Acceptance Phase.
10. Equipment Warrantees: Provide prior to the start of the Acceptance Phase.
11. Training Plan: Provide prior to the start of the Acceptance Phase.
12. Record Training Documentation: Provide at least 7 days prior to the start of the applicable training session. The compiled and final record training documentation will be provided by the CM within 14 days of the last training session provided under the construction contract (this will typically be the site-specific controls training). This will take the form of the Training Plan supplemented with evaluations and actual dates and topics.
13. O&M Documentation Content: Provide O&M Documentation content (including installation-specific instructions) to the CA for incorporation into the Systems Manual per the requirements of this Section, and Division 01 requirements. Submit at least one month prior to the beginning of the Acceptance Phase.

B. Record Drawings: Contractor shall maintain an updated set of record or 'As-Built' documents at the jobsite and electronically reflecting actual installed conditions and all approved changes and modifications to the contract documents. Contractor shall provide access to the CA to review the As-Built and Record Drawings. Provide Record Drawings in accordance with Division 01.

1.08 COMMISSIONING SEQUENCING AND SCHEDULING

A. Refer to the sequencing illustration at the end of this Section for a conceptual graphical representation of the precedents related to the Cx tasks. These precedents are generally to be applied per system and/or per area. Where applicable, in order to expedite the closeout of the facility, various systems can be in various stages of the Cx process. CA and Contractor shall cooperate to schedule the Cx tasks to minimize the duration of the Cx activities.

B. The Cx process will be categorized into Phases as indicated below and defined under the definitions paragraph above. Note that per schedule, different systems and/or areas may be in different phases at any given time given that the Cx program will be integrated into the construction process:

1. Construction Phase.
2. Acceptance Phase.
3. Endurance Phase.
4. Warranty Phase.

C. CA will provide a more detailed Cx tasking precedent diagram in Gantt chart format for direction of Cx precedents and approximate task durations.

D. Prior to submission of the baseline schedule, the scheduler will coordinate with the CA to specifically include the detailed tasks involved in the Cx process. CA will provide an initial "Precedent Diagram" that outlines the optimal Cx process. Scheduler shall meet with the CA and the subcontractors to synthesize the Precedent Diagram with the general construction process constraints and integrate the agreed upon process into the main construction schedule. Commissioning-related tasks shall be coded as such to facilitate generating a Cx fragnet that will be used during Cx progress meetings.

E. The Cx precedent schedule will outline generic Cx tasks with precedents or prerequisites to each task. These tasks, which will be shown generically for typical systems, will apply to many systems. Contractor shall incorporate the tasks into EACH SYSTEM. This will require a detailed track for each system and as such the scheduler must schedule and code by system as well as by area. The Cx precedent diagram will also indicate system precedent requirements for start-up and Functional

Performance Testing. Contractor shall collaborate with the CA to determine impacts of project phasing as applicable. Examples of enumerated tasks include:

1. Contractor preparation of draft Start-Up Documentation.
2. Contractor preparation of Training Plan.
3. Preparation of O&M Documentation content and other content for the Systems Manual.
4. Testing Agency activities.
5. Electrical Start-Up by system and zone group.
6. Mechanical Start-Up by system and zone group.
7. BAS Start-Up by system and zone group.
8. TAB by system and zone group.
9. Training Events.
10. Functional Performance Testing by system and zone group.

F. Contractor shall completely install; thoroughly inspect; start-up; and test, adjust, and balance systems and equipment. All activities shall be documented per specified procedures and progress tracked on the construction schedule.

G. Contractor shall notify CA at least 14 days in advance for all system and equipment Start-Ups, training, pressure tests, or system flush and fill. At their discretion, the CA shall witness selected Start-Ups, training events, or tests. Notification shall be accompanied by a schedule showing the coordinated start date and task duration and all currently open precedent requirements.

H. CM shall schedule and conduct System Turn-Over Meetings for all systems and equipment in the Cx scope as specified below. CM shall notify CA, A/E, and Owner in writing that systems are complete and ready for verification and Functional Performance Testing.

I. Notification of utility or system outages affecting current mission shall require advance notification per applicable Division 01 section.

J. Connections to or Interruptions of Existing Systems: Where the project entails connection to or interruption of existing functional systems that are supporting the Owner's mission, such connection activities must be shown as a milestone on the project schedule. Generally, these connections will require extensive coordination and a long period of pre-notification as defined in Division 01. Owner will not accept these connections unless the connection or outage is shown as a milestone 3 months prior to the event. The schedule will not be required to pinpoint the day and time 3 months in advance, however, it shall have been accurate to +- 2 weeks. The actual notification of the exact day and time shall be processed per applicable Division 01 section.

1.09 SYSTEM TURN OVER MEETINGS ('STOM' OR 'TURN-OVER')

A. CM shall schedule and conduct System Turn-Over Meetings ('Turn-Over') for all systems and equipment. Turn-Over is a quality control milestone in which all Contractors responsible for completing the installation and start-up of a system or equipment, along with the Owner and CM, meet to validate that the system or equipment is completed and operational per the contract documents and ready for Functional Performance Testing, and that all the Start-Up Documentation and nameplate data has been completed and is accurate. The CA will in many cases participate in this. CM shall organize and lead the process in all cases.

B. Notification shall be given of all System Turn-Over Meetings to the CA and the Owner via an Action Item posted on the Portal at least 14 days in advance of the activity. CA and Owner may elect to witness the Turn-Over, although it is not required. Primary responsibility of confirmation of the represented state of the equipment lies with the CM.

1.10 ELECTRONIC RECORD SUBMITTALS

A. Contractor shall submit a final electronic version of the submittal for Owner's future asset management within 14 calendar days after receipt of approval from the Owner and the Architect on any submittal for equipment in Divisions 11, 13, 21, 22, 23, 25, 26, 27 and 28.

B. Final Electronic Record Submittals shall:

1. Be originally authored in electronic media and not scanned versions with hand mark-ups unless specifically approved otherwise.
2. Be provided in Portable Document Format (*.pdf) with selectable text and graphics that are readable. The documents shall be merged into one bookmarked document up to 500 MB. Merged documents shall use hierarchical bookmarks to form a table of contents and provide hyperlinks to the subject topic. Submittals larger than 500 MB, provide a summary document in PDF or HTML format with relative hyperlinks to the associated document files within the same directory or in directories subordinate to the summary document.
3. Include all final ratings, parameters, specifications, options, etc. In the case where the Architect returns the submittal "Approved-As-Noted, Resubmission-Not-Required" and includes mark-ups or comments that change the originally submitted ratings, parameters, specifications, options, etc., the Contractor shall correct the documents in the original electronic document prior to submitting the final electronic documents.
4. Highlight the specific rating, parameter, specification, option, etc. when the original document includes multiple alternatives. For instance, when a range of performance parameters are given or various sizes are shown, or various options are listed, the applicable item shall be indicated by highlight, circle, pointer, or other electronic marking. Partial-page material in the submittal that does not pertain to the project can be masked with a transparent gray screen over the text; entire pages that are not applicable may be electronically deleted.
5. Do not include generalized direction from the Architect that does not relate to ordering and purchasing the equipment. For instance, notes such as "Coordinate with mechanical engineer for final motor horsepower" are not to be transferred to the electronic submittal. In that example, only the final coordinated sizes shall be indicated.

C. Final Electronic Record Submittals shall be either posted to the project web site or provided on compact disc.

1.11 MANAGEMENT PROTOCOL COORDINATION

A. Coordination responsibilities and management protocols relative to Cx are initially defined below but will be refined and documented in the Construction Phase Cx Kick Off meeting. Contractor shall have input in the protocols and all Parties will commit to process and scheduling obligations. The CA will record and distribute.

1. Submittals and Shop Drawings: Owner or A/E shall distribute these to the CA. CA shall edit the project's submittal log to communicate which submittals must be forwarded to CA.
2. CA Review Comments on Shop Drawings: Comments shall be included in Cx issues log, and a copy sent directly to the A/E and Owner by the CA. A/E shall consider and incorporate at their discretion.
3. Deficiencies Identified by the CA: When the CA identifies a deficiency, CA shall make a good faith assessment of responsible parties. Those parties, as well as Owner and/or A/E shall be notified of the perceived deficiency. This communication is FOR INFORMATION ONLY and is not a directive to any party to resolve the deficiency. Contractor may accept responsibility and resolve the deficiency voluntarily. If Contractor contests either the deficiency or responsibility for that deficiency, Contractor shall respond to that deficiency

indicating disagreement. If responsibility is not agreed to via the Cx dialogue, Owner shall issue a work directive or RFI via the normal contractual channels to resolve the issue.

4. Requests for Meetings: Request by the Contractor for a meeting with the CA shall be routed through the Owner and/or A/E who will then determine the validity. Note that every attempt should be made to deal with Cx issues at regularly scheduled Cx Meetings.
5. Control Sequence Modifications: CA shall make every attempt to thoroughly review the sequences during the submittal phase and address any issues prior to the submittal approval. However, CA and the BAC may incorporate minor changes to the sequence during testing when it is apparent that it improves the control of the equipment but does not fundamentally change the sequence. The time required by the BAC for this type of modification is addressed in Section 230800. Any and all changes must be thoroughly documented in the record documents.
6. Scheduling Coordination: CA shall consult directly with the Owner and/or A/E to incorporate the Cx tasks in the project schedule. The process logic and integration shall ultimately be a collaboration between CM, CA, and subcontractors. The effort will start with CA and CM proposing initial logic. Then subcontractors will join the discussion and work out the final details, (precedent logic and durations).
7. Notification of Completion Milestones: Contractor shall notify Owner and/or A/E at least two weeks prior to an anticipated Cx activity or milestone (such as Turn-Over). Owner and/or A/E shall then coordinate the scheduling of the activity (as applicable) between all required parties as applicable. Notification shall be posted using the Portal (events module) with an associated Action Item distributed to interested parties.
8. Action List: CA maintains a categorized Action List which tracks the Cx-related action items. All content of the Action List will be available to all parties who have credentials on the Portal. Any party with credentials may post an Action Item. Any party that is copied on an email resulting from an Action Item posting may respond to it and contribute to the dialogue.
9. Start-Up Checklist and Test Documents: CA will provide initial 'generic' Start-Up Documents to the Contractor. The Contractor shall synthesize these with the manufacturer-specific start-up procedures and submit both to the CA for review and approval. The Contractor has the option of modifying the supplied generic procedures in the delivered format, or by supplementing these with their own procedures. The Contractor then executes, signs, and submits the final reviewed and approved Start-Up Documentation. The CA subsequently (and optionally) spot-checks the procedures and documentation at the 'System Turn-Over Meeting'. The Start-Up Documentation is then included in the Commissioning Record.
10. Functional Performance Test Documents: Functional Performance Tests are prepared and completed by the CA. They are developed during the construction phase, after BAS submittals have been submitted and approved. CA forwards the FPT procedures to the CM to be subsequently distributed to the Contractors for review. Contractors approve the procedures. Throughout the Cx process, CA maintains a current record of the FPTs and their results and keeps the documentation up to date and accessible for all to access the current progress. CA distributes hard copies of the FPTs at the completion of any significant stage of commissioning.

1.12 CONTRACTOR RESPONSIBILITIES

A. Construction Phase: The following delineates the commissioning-related responsibilities of the Contractor (and their subcontractors) during the Construction Phase.

1. Include Cx requirements in price and plan for work.
2. Designate a Commissioning Coordinator (CxC) from each major subcontractor with activities related to commissioning. These Commissioning Coordinators are to be the primary contacts for Cx activities.

3. Attend Construction Phase Cx Kick Off Meeting. The CxC and Project Manager from each major subcontractor shall attend.
4. The CxC shall attend all Cx progress meetings unless otherwise agreed to by the CA.
5. Remedy any deficiencies identified throughout construction.
6. TAB shall submit sample balancing forms for approval prior to starting work.
7. Schedule and coordinate Cx efforts into the construction schedule. Incorporate the precedent diagram provided by the CA into the construction schedule. Indicate at a minimum all tasks enumerated on the precedent diagram for all systems.
8. Coordinate the work of subcontractors, vendors, manufacturers, and Testing Agencies provided with the bid, and ensure that they are informed of and are adhering to the requirements of the Cx process specified throughout the contract documents.
9. Contractor-Developed Documentation: Contractor shall develop and submit the following information as specified:

    a. Draft Start-Up Documentation (submit along with the manufacturer's application, installation, and start-up procedures).
    b. O&M Documentation content as specified.
    c. Systems Manual content as specified.
    d. Training Plan, and materials and documentation of training.
    e. Temporary Operating and Conditioning Plan content as specified.
    f. Piping Cleaning, Flush, and Fill Plan, content as specified.
    g. Comprehensive integrated procedures for scheduling and task notification and documenting them in a common format.

10. Provide assistance to the CA in preparation of the specific Functional Performance Test (FPT) procedures. Contractors, subcontractors and vendors shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests. Damage caused to equipment performed in accordance with the approved procedures will be the responsibility of the Contractor.
11. Thoroughly complete and inspect installation of systems and equipment as detailed throughout Contract Documents, as required by reference or industry standards, and as specifically indicated elsewhere this Section.
12. Start-up, test, adjust, and balance systems and equipment prior to verification and Functional Performance Testing by the CA. Start-Up Documentation shall be in accordance with Contract Documents, reference or industry standards, and specifically individual Cx specifications. Provide skilled technicians qualified to do the work required. Provide factory trained/authorized technicians where required by the contract documents and stated in the applicable technical section. Start-Up and Functional Performance Testing shall proceed from device checkout, to component checkout, to system checkout, to inter-system checkout.
13. Prepare spaces with adequate security for on-site contractors to store equipment. Provide secure space with 120 volt AC power for the CA, TAB, and BAC to base their operations and store test equipment, drawings, files, and the like.
14. Schedule for any required representative space mock-ups as early as possible to facilitate determining standards for closeout.
15. Record Start-Up procedures on approved Start-Up Documentation and certify that the systems and equipment have been started and or tested in accordance with the requirements specified above. Each task or item shall be indicated with the party actually performing the task or procedure.
16. Provide skilled technicians qualified to perform the work required.
17. Provide factory-trained and authorized technicians where required by the Contract Documents.
18. Tag equipment that is started with the Individual's name and date.
19. Demonstrate the operation of all systems as specified.
20. Certify that systems have been installed and are operating per Contract Documents prior to Functional Performance Testing.

21. Maintain an updated set of Record Documentation as required by the Contract Documents.
22. Copy the CA on indicated documentation.
23. Conduct and document Equipment and Systems Training events as required by this Section and by applicable sections of the Specifications pertaining to each piece of equipment or system.

B. Acceptance Phase: The following delineates the Cx-related responsibilities of the Contractor (and their subcontractors) during the Acceptance Phase.

1. Assist CA in Functional Performance Testing. Assistance will typically include the following:

    a. Manipulate systems and equipment to facilitate Functional Performance Testing (as specified in Section 019110 and the Cx Plan; in some cases this will entail only an initial sample).
    b. Provide any specialized instrumentation necessary for Functional Performance Testing.

2. Correct any work not in accordance with Contract Documents.
3. Participate in Training Events relative to use of O&M information and the preventative maintenance program.
4. Maintain record documentation, and update and resubmit it when Acceptance Phase is completed.
5. Compensate CA for additional site time incurred due to incompleteness of systems or equipment at time of Functional Performance Testing.
6. Monitor systems, equipment, and areas throughout the Endurance Period. Log and diagnose all alarms during this period. Maintain trends and logs of all critical parameters. Forward the logs and trends on a weekly basis throughout all Endurance Periods.

C. Warranty Phase: The following delineates the Cx-related responsibilities of the Contractor (and their subcontractors) during the Warranty Phase.

1. Provide warranty service.
2. Conduct Final Systems Operation Training (BAC lead).
3. Respond to and document warranty issues.
4. Participate as required in opposite season testing.
5. Correct any deficiencies identified throughout the Warranty Phase.
6. Update record documentation to reflect any changes made throughout the Warranty Phase and resubmit final Record Drawings at the close of the Warranty Phase.

1.13 EQUIPMENT SUPPLIER AND VENDOR RESPONSIBILITIES

A. Construction Phase: The following delineates the Cx-related responsibilities of the Equipment Supplier (and their subcontractors) during the Construction Phase.

1. Provide shop drawings and product data in hard copy and electronic format.
2. Provide manufacturer's application, installation, and start-up instructions within 30 days of shop drawing/product data approval.
3. Where factory-authorized start-up is specified, coordinate, and participate in the specified Cx process and document start-up on the appropriate forms.
4. Review and approve Functional Performance Test procedures affecting supplied equipment.
5. Where training is to be provided by factory-authorized personnel, provide required Training Plan information including course content for approval prior to conducting the training.

6. Conduct and document Equipment and Systems Training events as required by this Section and by applicable sections of the Specifications pertaining to each piece of equipment or system.
7. Provide spare parts and materials as required by the specifications.
8. Provide special tools as required by the specifications.
9. Provide Systems Manual content as required and develop project-specific O&M content as required by the Cx requirements.
10. Provide all warranties.

B. Acceptance Phase: The following delineates the Cx-related responsibilities of the Equipment Supplier (and their subcontractors) during the Acceptance Phase.

1. Participate in any Functional Performance Testing required.
2. Consult on issues identified relative to the supplied equipment.]

C. Warranty Phase: The following delineates the Cx-related responsibilities of the Equipment Supplier (and their subcontractors) during the Warranty Phase.

1. Provide any warranty service required to the supplied equipment as applicable with the agreement with the Contractor.
2. Maintain Systems Manual content relative to supplied equipment.
3. Provide technical support to the Owner's facilities personnel.

1.14 COMMISSIONING KICK-OFF COORDINATION MEETING

A. CA shall schedule and conduct a Cx coordination meeting near the beginning of construction. The following should be discussed at this meeting:

1. The commissioning documents (specifications and Cx Plan).
2. Requirements and sequence of commissioning.
3. Responsibilities of the construction parties.
4. Management protocols.
5. Required submittals.
6. Schedule.

1.15 START-UP AND START-UP CX PROCESS DOCUMENTATION

A. Purpose: The Cx process requires that the normal quality control processes involved with preparing systems and equipment for operation are performed to a high standard of care and are thoroughly documented. The required Cx-related Start-Up Documentation is no more than that which would be provided for any good installation. These procedures shall be performed to all installed systems and equipment and no sampling strategy is used for the Start-Up process. The Cx process requires all Parties to collaborate to establish the optimal standard of care for starting systems and equipment. After the procedures are established, the Contractor performs them and documents them with the Start-Up Documentation that is developed through the joint effort of the Contractor and the CA.

B. Creation of Start-Up Documentation: Start-Up Documentation (consisting of checklists and tests as defined above) shall be developed by the Contractor and appropriate manufacturers for each type of equipment and system being installed for this project. It shall be submitted to the CA for approval prior to actual equipment Start-Up. Contractor shall develop Start-Up Documentation based upon a combination of (i) the 'generic' procedures prepared by the CA (see below); (ii) existing procedures and checklists included in the Contractors in-house quality assurance process, and (iii) those

procedures required by the manufacturer. Contractor shall provide the CA with an electronic copy of manufacturer's application, installation, and start-up information at the time they submit the Start-Up Documentation. The CA shall then approve the Start-Up Documentation. Approved Start-Up Documentation shall reflect all project-specific values, settings, targets, acceptance criteria, and other parameters as appropriate. Final approved Start- Up Documentation shall be provided in electronic format.

C. 'Generic' Start-Up Documentation: Refer to Sections 230800 and 260800 for 'generic' Start-Up Documentation for a variety of HVAC, mechanical and electrical systems. The content of the 'generic' Start-Up Documentation shall provide the minimally acceptable content. Generic refers to the fact that these procedures and protocols are common for most types of equipment and systems across different manufacturers. The Contractor is responsible for customizing this material to reflect the actual equipment and systems selected.

D. Manufacturer/Vendor Installation and Start-Up Documentation: Contractor and Vendors shall provide manufacturer's preprinted and standard installation checklists, forms, and protocols both for review early in the construction process and to as required to document the Start-Up process towards the end of the Construction Phase. After the approval of the shop drawings and product data, Contractor shall submit manufacturer's start-up procedures and application guidelines for all systems, equipment, and components. These shall be submitted in electronic PDF format for review and approval. Submittal of the information shall be within 30 days of the submittal approval.

E. Content of Start-Up Documentation: Start-Up Documentation shall generally include the following for each item of equipment or system (as applicable):

1. Project-specific designation, location, and service.
2. Indication of the Party performing and documenting the Start-Up.
3. Clear explanation of the inspection, test, measurement, and outcome with a Pass/Fail indication and a record of measured parameters (as applicable).
4. Include a checklist item indicating that all O&M Documentation, Warranties, and Record Documents have been completed and submitted.
5. Include a Start-up Checklist item indicating that proper maintenance clearances have been maintained.
6. Include a Start-up Checklist item indicating that special tools and/or spare tools required for normal operation and maintenance were turned over to the Owner.
7. Include Start-up Checklist item indicating that all required dependent or prerequisite equipment and systems were previously started successfully.

F. Manufacturer's Requirements: Start-Up Documentation shall incorporate all manufacturer- specified procedures. As applicable, include acceptance criteria specified therein. The manufacturer's start-up and checkout procedures shall be submitted to the CA along with the Contractor's draft Start-Up Documentation.

G. Recording and Documentation of the Start-Up: Manufacturer's start-up protocols shall be executed, and forms shall be completed by a qualified/authorized technician. These shall be developed and submitted electronically or at the discretion of the CA they may be scanned and submitted electronically. Electronic documentation of manufacturer's start-up protocols shall be linked into the applicable test on the Portal.

H. Recording and Completion of Start-Up Checklists and Tests: A qualified technician from the responsible installing Contractor or manufacturer's start-up technician shall document the Start- Up on the approved Start-Up Documentation forms. The individuals executing the Start-Up shall acknowledge acceptability of each item with the indication of who performed the associated task. The Start-Up is not considered complete until the Start-Up Documentation has been completed and entered electronically on the Portal. Information documented manually on paper in the field and/or installation or start-up information developed by the manufacturer must be transferred to the

electronic file before Turn-Over can be scheduled. The completed documentation shall be presented and reviewed at the System Turn-Over Meeting.

I. CA Review: CA shall review the completed and submitted Start-Up Documentation and request any incomplete data or additional information required to meet the Cx program criteria. CA will also review and spot-check procedures during Functional Performance Testing.

J. Systems Subject to Start-Up Documentation and Turn-Over: All (100% of) systems shall undergo a documented Start-Up per the approved procedures and NO sampling strategy is used. Completed Start-Up Documentation for all pieces of equipment shall be submitted to CA prior to Turn-Over or any associated Functional Performance Testing. Any outstanding item shall be clearly indicated, and an associated Action Item must be entered to track resolution.

K. Owner Access: Contractor shall allow access by Owner representatives at any time to inspect the equipment and ensure its proper operation. Owner will be allowed to affix service tags to equipment to track the proper maintenance.

L. Mechanical Contractor -Specific Documentation Requirements:

1. The Division 23 Contractor shall provide the following documents as specified in Section 230800:

a. Piping Cleaning, Flush, and Fill Plan.
b. Temporary Operation and Conditioning Plan (if permanent systems are to be used to condition the building during Construction Phase).

1.16 EQUIPMENT NAMEPLATE DATA

A. Contractor shall provide as-installed specific product nameplate data, product numbers, serial numbers, and other information required to fully define the asset for Owner's use in maintenance management and asset tracking and BIM Modeling. This data shall be provided electronically to ease in the data transfer to the computerized maintenance management system. Coordination of the format required shall be arranged by the Contractor prior to initial construction implementation.

1. Acceptable forms of electronic submittals are:

a. Microsoft Excel spreadsheet arranged with a separate 'Sheet' for each type of equipment and with individual pieces of equipment entered as rows and the applicable values to be recorded as column headings.
b. Microsoft Access database arranged with a separate 'Table' for each type of equipment and with individual pieces of equipment entered as rows and the applicable values to be recorded as fields. Field formats will be as determined at the Construction Phase Commissioning Kickoff Meeting.
c. Text document formatted as Comma Separated Values (csv) with a separate file for each type of equipment, the first row including the field or column names and subsequent entries for each individual piece of equipment as rows.

2. Minimum nameplate data content shall include the following as applicable:

a. Construction document designation.
b. Owner's designation if different than the construction document designation and if provided by the Owner.

c. Contact information identification which shall reference the project's Contact List for installing contractor, vendor or representative, and manufacturer. Contractor shall also provide identification for suppliers of parts if different from the previous parties.
d. Model Number.
e. Serial Number.
f. Date of Manufacture.
g. All performance and sizing data required to operate, diagnose, or replace the system, equipment, component, or systems with as a minimum that indicated in the construction documents.
h. General description or type classification of the system, equipment, component, or device.

B. Contractor shall provide Equipment Nameplate Data for all equipment provided as work of this Division.

1.17 FUNCTIONAL PERFORMANCE TESTING

A. The objective of Functional Performance Testing is to demonstrate that each system is operating according to the documented OPR/Basis of Design and Contract Documents. Functional Performance Testing facilitates bringing the systems from completed Start-Up to Functional Completion. During the FPT, areas of deficient performance are identified and corrected, improving the operation, and functioning of the systems. System parameters are further tuned and optimized to provide for stable control and interrelated system effects are also addressed.

1.18 FUNCTIONAL PERFORMANCE TESTING DEFICIENCIES

A. Non-conformance deficiencies, e.g. test failures, installation, and configuration errors, etc., identified during Functional Performance Testing shall be resolved as follows:

1. The CA will record the results of the functional test in the project database. All deficiencies or non-conformance issues shall be noted as Action Items and reported to the Owner and A/E.
2. Corrections of identified minor deficiencies may be made during the tests at the discretion of the CA. In such cases, both the deficiency and associated resolution will be documented in the database.
3. Every effort will be made by the CA to expedite the FPT process and minimize unnecessary delays, while not compromising the integrity of the procedures.
4. As tests progress and a deficiency is identified, the CA will discuss the issue with the executing Contractor.

a. When there is no dispute on the deficiency and the Contractor accepts responsibility to correct it:

1) The CA shall document the deficiency along with the Contractor's response and intentions, and then proceed forward to another test. A copy/email of the deficiency shall be generated and provided to the Contractor and CA. The Contractor shall then correct the deficiency, complete the Action Item response certifying that the issue is resolved and /or the equipment is ready to be retested, and sends it back to the CA.
2) The CA reschedules the test, and the test is repeated until satisfactory performance is achieved. CA then closes the Action Item.

b. If there is a dispute about a deficiency, regarding whether it is a deficiency and/or who is responsible:

1) The deficiency shall be documented as an Action Item with the Contractor's response and the Owner and A/E will be notified. The Owner will track this issue under the construction contract dispute resolution provisions.
2) Final interpretive authority is with the A/E. Final acceptance authority is with the Owner.
3) The CA documents the resolution to the Action Item.
4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, and responds to the Action Item indicating completion. The CA reschedules the test, and the test is repeated until satisfactory performance is achieved. CA then closes the Action Item.

B. Failure Due to Manufacturer's Defects. If 10% or three, whichever is greater, of identical pieces of equipment fail to perform to the required Contract Document criteria (mechanically or substantively) due to manufacturing defect, all identical units may be considered unacceptable by the Owner. (For the purposes of defining 'identical equipment' for this Section, size or capacity alone does not constitute a difference.) In case of failure due to manufacturer's defects, the Contractor shall provide the Owner with the following:

1. Manufacturer's response in writing as to the cause of the failure and proposed resolution.
2. Manufacturer shall implement their proposed resolution on a representative sample of the product.
3. The Owner will determine whether a replacement of all identical units or a repair is acceptable.
4. Upon acceptance, the manufacturer shall replace or repair all identical items at their expense and shall extend the warranty accordingly (if the original equipment warranty had begun).
5. Manufacturer or Contractor shall pay the costs of all retesting necessitated by the failure.

1.19 OBSERVATION PERIOD

A. General: The Observation Period is defined as a period of time either prior to or immediately following Functional Performance Testing where the BAS is shown to operate properly without malfunction, without alarms caused by control action or device failure, and with smooth and stable control of systems and equipment in conformance with these specifications.

B. Prerequisites: The CA will determine when the BAS has been substantially completed to allow for the start of an informal Observation Period as defined above. Observation Period may be witnessed in phases only on larger more complex projects where interdependencies between phases are not a factor.

1.20 TRAINING

A. General: Adequate and thorough training of the Operators and the facilities staff is vital to effective transition and early occupancy of the building. A key goal of the Cx program is to ensure this is accomplished. Contractors, subcontractors, and Manufacturers/Vendors as specified shall prepare and conduct training sessions on the installed systems and equipment for which they are responsible. The Contractor shall be responsible for insuring all training is performed in accordance with the Contract Documents.

B. Training Events Overview: Training Events include all classroom and field-based training sessions that result in the training or transference of design team or Contractor knowledge to the Owner. The following Training Events shall be executed as part of the Training Program:

1. Design Orientation Training: The purpose of the one-time Design Orientation Training event is to acquaint the Owner and Contractors with the facility design strategies and approach taken by the Design Team. The mechanical design engineer is responsible for conducting and documenting this training, with assistance and support from the CA. Material from the Owner's Project Requirements and Basis of Design Documents shall be covered during this training. An overview of the facility and its systems, the system design goals and the reasoning behind the selection of the equipment will be reviewed. The CA will also review the upcoming Start-Up process and FPT/Acceptance Testing procedures. An optional tour will be provided at the conclusion of the event.
2. Equipment and Systems Training: The Contractor (or Manufacturer's Representative) shall provide training to the Owner/Operators on individual systems and equipment only after successful Start-Up. These training events cover proper operation, maintenance, repair, and diagnosis of the systems, equipment, and components installed by the Contractor. Details and required content are provided elsewhere in this Section.
3. Final Systems Operation Training: The BAC shall provide this training to the Owner and Operators on whole-building operation. This training shall focus primarily on BAS control of building systems and operation and its impact on building performance, and shall be conducted after Functional Completion.

C. Training Means, Methods, and Documentation: The Contractor must document all training sessions. Details on the means and methods for conducting and documenting training, including location requirements, preparation, methods for presentation, scheduling, recording, instructor qualifications, and other details are specified below.

1. Trainer must supply a Training Plan Document as detailed below, at least 2 weeks prior to the scheduled training session for approval by the Owner and CA.
2. Setting: Training sessions should typically start and end in a classroom setting. Field demonstrations shall be conducted to demonstrate the hands-on aspects of the required tasks.
3. Presentation: Training shall include electronic presentation materials. Presentation materials shall be submitted by the Contractor within the Training Plan. Contractor shall provide audio/visual equipment as required to communicate to a minimum of 10 attendees.
4. Documentation: Subcontractors or Vendors must document the training sessions in a Training Record. Beyond that included in the Training Plan, documentation shall include the names of the attendees and their evaluations. Training shall follow handouts that list the key points in bullet form presentation style or follow detailed written documentation. Training will not be approved unless it contains accompanying handout documentation to every attendee for their own use and record, separate from the master copy for the Training Record. All documentation must be provided in PDF electronic format. All handouts and presentation slides shall be included in the documentation.
5. Evaluations: All training sessions must be evaluated by the participants. CA shall develop an evaluation form that assesses the quality of the presentation, the quality of the content, and provides a forum for feedback of items the attendee feels should be provided or expanded on. The Contractor that organizes the sessions is responsible for distributing the evaluations, ensuring they are completed, and compiling them and forwarding them to the CA.

D. Training Plan Document.

1. The Training Plan shall outline the various Equipment and Systems Training events and Final Systems Operation Training event as proposed by the Contractors, and shall be approved by the CA. Contractor shall compile the individual training agendas of the subcontractors and vendors and submit a comprehensive Training Plan to the CA, Architect and the Owner for review. Training Plan shall summarize all Equipment and Systems Training events with topics to be covered and approximate training duration.
2. The Training Plan shall include at a minimum:

a. Topic and applicable specification section.
b. Scheduled date(s) for the Events(s).
c. Location and setting (classroom or field).
d. Lead instructor and instructors qualifications.
e. Co-instructors and their qualifications.
f. Training objective.
g. Event outline/agenda.
h. Detailed breakout of content to be presented.
i. Anticipated duration.
j. Required attendees for each session.

3. Review: Contractor shall submit the Training Plan to the CM, who will then disseminate it for review to the Cx Team. Contractor shall incorporate comments and requirements resulting from the review and resubmit the Training Plan prior to conducting any training sessions.

E. Training Prerequisites: Equipment and Systems Training ("Training") shall not be conducted until the subject system or equipment has completed Start-Up Documentation requirements and Turn-Over. If the Contractor wishes to schedule both Turn-Over and Training on the same day/visit and if the systems are discovered to not be fully functional at that time, Training shall be canceled and rescheduled.

F. Equipment and Systems Training – Description and Content.

1. Description: Equipment and Systems Training events will typically occur over a period of time as systems and equipment are brought online and Turned Over. Training shall cover proper operation, maintenance, repair, and diagnosis of the systems, equipment, and components installed by the Contractor. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. These sessions shall use the manufacturer's printed installation, operation and maintenance instruction material and shall include a review of these instructions emphasizing safe and proper operating requirements and preventative maintenance. Training shall follow handouts that list the key points in bullet form presentation-style or follow detailed written documentation. Training will not be approved unless it contains accompanying written documentation.
2. Equipment Covered: Training shall be provided for all major items of equipment within the scope of commissioning and per the Specifications.
3. Minimum Training Content: Equipment and Systems Training shall include as a minimum for each type of equipment:

a. Presentation of the equipment within the context of this facility. Typically, the responsible subcontractor shall provide this introduction to the session. The trainer shall review how the equipment serves this specific facility. Information shall include equipment amounts, numbers, capacities, sizes, and locations and shall show the equipment in applicable system schematics.
b. Conceptual overview of how the equipment works.
c. Names, addresses, phone numbers, websites of sources for information, tools, spare parts, and other details for the equipment.
d. Details of the warranty or guarantee.
e. Intended sequences of operation in all modes of operation.
f. Limits of responsibility (example: unit-mounted controls vs. BAS).
g. Sources of utility support.
h. Routine operator tasks involving monitoring and operation, covering all modes of operation and mode switching as applicable.
i. Relevant health and safety practices/concerns.
j. Common problems and their diagnosis and repair.

k. Proper maintenance schedules, tasks, and procedures with demonstrations.
l. Emergency response, documentation, and recovery procedures.

4. Scheduling: These events shall be coordinated through the CA, but be scheduled by the CM.
5. Attendees: Contractor shall insure that all appropriate subcontractors be present for these sessions. Any Cx Team member is eligible to attend. Required attendees include the applicable Contractors (Lead), CA, and the Owner/Operator.

G. Final Systems Operation Training.

1. Description: Final Systems Operation Training provides the Owner and Operators a training session on whole-building operation. It shall focus primarily on BAS control of building systems and operation and its impact on building performance. System interactions shall be presented and discussed (such as a combined air handler, chiller, boiler, and terminal unit system), along with a detailed presentation of the sequences of operation and their relationship to the BAS. This training shall be conducted by the BAC with assistance from the CA, and shall be attended by the Owner, Operators, Contractor, Design Team, and by any other Cx Team members deemed necessary by the CA or the Owner.
2. Coordination with BAS Training: Detailed BAS component training for the facility Operators shall be considered as part of Equipment and Systems Training. This training shall have been completed prior to Final Systems Operation Training.
3. Scheduling: Final Systems Operation Training shall be conducted after all FPTs have been successfully executed.
4. Attendees: Any Cx Team member is eligible to attend. Required attendees include the BAC (lead), CA (assist), CM, mechanical contractor, A/E, and Owner/Operators.

1.21 CONTRACTOR REQUIRED O&M DOCUMENTATION

A. Contractors are responsible for submitting their own developed O&M Manuals per the Contract Documents and for developing installation-specific O&M Documentation.

B. O&M Documentation Content: Content for one system and all associated equipment must be organized and made in one submission. However, systems may be submitted separately based on the progress of the project. Content shall be provided and indexed separately as ‘Operations Manual’ and ‘Maintenance Manual’ as specified below.

C. This Part shall be organized by Division then system/subsystem using a systems approach.

1. Contact Information: Provide contact cross-references to the Parties applicable to the system being described and contained in the main Contact Directory in the Commissioning Plan.
2. Start-Up and Shutdown Procedures: Provide step-by-step instructions to bring systems from static to operational configurations and from operating to shutdown status. Installing Contractor or Vendor/Manufacturer shall author this specifically for this project.
3. Normal Operating Instructions: Provide a discussion of the normal operation and control of the system. Address operating norms (for example, temperatures, pressures, and flow rates) expected at each zone or phase of the system. Supplement the discussion with control and wiring diagrams and data. Installing Contractor or Vendor/Manufacturer shall author this specifically for this project.
4. Emergency Operating Instructions: Provide emergency operating procedures in the event of equipment malfunctions. Provide shutdown instructions for fires, explosions, spills, or other contingencies. Installing Contractor or Vendor/Manufacturer shall author this

specifically for this project. This content shall be in the context of the systems themselves and support the Emergency Operations manual to be created by the Owner.

5. Environmental Considerations: Provide a listing of the equipment that requires special operation, reporting, testing, analysis, or inspection to comply with federal, state or local environmental laws. Examples of possible list items include backflow preventer inspections, underground storage tank testing, hazardous material or waste usage/storage documentation and air pollution control devices. For each item, include requirements for environmental operation, reporting, testing, analysis, and inspection as well as references to respective implementing regulations, statutes or policies.
6. Equipment and System Training Documentation: Include documentation of training for applicable system. Include training agenda, all handouts and presentation materials/content. Reference existence and index of DVD or video tape recording.
7. Sequence of Operation/Control Schematic: Provide the written sequence of operation for the applicable system and the control schematic diagram. This information may be obtained from the A/E or design team members.
8. Maintenance Service Agreements: Provide copies of maintenance service agreements where there pertain to systems involving multiple components and devices as indexed in Part 3.
9. Testing, Adjusting, and Balancing Reports: Insert the TAB Reports provided under Section 230593 for the subject system.

D. Maintenance Manual.

1. Organize this section first by discipline then by equipment number or ID.
2. Maintenance Index: Provide a summary table that indexes the equipment requiring maintenance and indicates the frequency each piece of equipment needs attention, and a reference to the number of the Procedure associated with that frequency. CM shall provide Contractors with an Excel spreadsheet that will be completed by each applicable subcontractor and returned to the CM for incorporation in the Systems Manual.
3. Maintenance Information: Maintenance Information for each indexed entry shall contain the following:

    a. Equipment Data Sheet: Provide a summary of key nameplate and performance data.
    b. Procedures: Provide a ‘Task Card’ or step-by-step procedures for each individual maintenance procedure for a given frequency identified on the Maintenance Index. Include detailed PM procedures, safety instructions and precautions including Lock Out/Tag Out precautions, required skill level, number of personnel needed, frequency, special tools needed, parts needed and estimated time required to complete the task. These procedures shall be indexed in a manner approved by the Owner. These shall be provided as Microsoft Word files or scanned documents from the manufacturer’s O&M Manual in either PDF or JPG formats).
    c. Field Test Reports: Provide Field Test Reports that apply to equipment associated with the system.
    d. Troubleshooting Instructions: Provide detailed troubleshooting instructions indexed by common/expected symptoms. Alternatively, make specific reference to page in the manufacturer’s O&M Manual where this information is provided.
    e. Extended Warranty Information: Include all warranties for products, equipment, components, and sub-components whose duration exceeds one year. Include warranties on components with the system they are contained within. Reference all specific operation and maintenance procedures that must be performed to keep the warranty valid.
    f. Special Tools: Provide a listing of any special tools required for servicing, diagnosis, or repair. Alternatively, reference specific page in the manufacturer’s O&M Manual where this information is provided.

g. Supply Inventory Requirements: Provide a list of maintenance and repair supplies (e.g., spare parts, fuels and lubricants) required to ensure continued operation without unreasonable delays. Identify and list parts and supplies that have long purchase lead times. Alternatively, reference specific page in manufacturer's O&M Manual that contains this information.

h. Sources of Spare Parts: Provide list or reference to recommended spare parts and contact information where spare parts can be obtained.

i. Lubrication Schedule: Provide a lubrication schedule indicating types, grades, and capacities of lubricants for specific temperature ranges and applications. Alternatively reference the specific page in the manual that contains this information.

j. Maintenance Service Agreements: Provide copies of maintenance service agreements where they pertain specifically to indexed equipment.

k. Manufacturer's O&M Manual: Include manufacturer's printed O&M information. These shall be provided in PDF format. If unavailable as PDF from the manufacturer, hardcopy manual shall be scanned and provided as a single file.

l. Application and Installation Instructions: Where applicable and separate from the O&M information, provide the Application and Installation Instructions that indicate how to correctly apply and install/setup the equipment.

E. O&M Documentation Format: Content authored, developed, and compiled by the Contractor shall be available both electronically and hardcopy. Specific electronic format shall be coordinated with the CA. Acceptable electronic formats shall allow for editing and commenting, and include Microsoft Word, Excel, PowerPoint, Access, and Visio; Portable Document Format (PDF), AutoCAD, graphics/photo formats such as JPG,

F. Mechanical Contractor O&M Documentation Submittal: The Division 22 and 2] Contractor shall compile and organize the content for all work of Divisions 22 and 23 and provide one organized submittal. Upon approval by the CA, the content may be provided in multiple system and equipment-level submittals. Each submission shall be provided at least one month prior to the start of the Acceptance Period. This submittal will be reviewed by A/E, CA, Owner, and CM within two weeks of the submission. Contractor shall incorporate comments and corrections and resubmit prior to the start of the Acceptance Period. Within two weeks of Functional Completion, the Division 22 and 23 Contractor shall provide the final version of all O&M Documentation information in one submittal.

G. Other Contractor O&M Documentation Submittals: Submittals by all other Contractors (other than Div. 22 and 23 shall be provided per specifications within their respective Division of work.

H. Maintenance and Updates of O&M Documentation Content: Contractors shall maintain the applicable O&M Documentation content throughout the Warranty Period. All hard copies will be retained at the Owner's facilities or electronically online at a web-based site. Changes throughout the Warranty Period shall be fully coordinated with the CA. Maintenance of O&M Documentation content shall include:

1. Changing any indicated settings, parameters, and other operational parameters that were changed by the Contractor during the Warranty Phase.
2. Changing any instructions as to procedures that needed to be changed during the Warranty Phase.
3. Changing the Record Schedules and/or Sequences of Operation if they were changed during the Warranty Phase.
4. Updating any O&M Documentation content if changed or updated by the manufacturer.

I. Electronic Copies: Electronic copies may be posted to the Portal. When a posting is made, emails shall be sent to the receiving Parties (and copied to any other interested Parties) stating that the submission has been posted. Posting needs only to be the current submission. Contractor shall maintain all versions of the submission and provide upon request. When electronic submissions

are made on electronic media such as CDs or memory sticks, six copies of the electronic media shall be provided.

1.22 SYSTEMS MANUAL PREPARATION AND LOGISTICS

A. Definition: The Systems Manual is the final deliverable from the Cx process, and provides the information needed to understand, operate, and maintain the facility and its systems. It is typically developed by the CA but with content required to be provided by the design team and the Contractors. The Systems Manual expands the scope of standard O&M documentation to incorporate additional information developed through the Cx process. The Systems Manual should be the repository of all updates and corrections as they occur (even throughout Occupancy). It is narrative in nature and organized by system types and by area/usage of the facility (if applicable). Systems Manual content typically includes narrative descriptions of the facility and systems, sequences of operation, schematic diagrams, cuts from design drawings and equipment literature, photos, and manual start/stop and emergency operating procedures for important equipment.

B. Systems Manual Lead Developer Responsibilities: The lead developer of the Systems Manual for this project shall be the CA. The lead developer is responsible for organizing and producing the Systems Manual and for managing the content and contributions from the Parties responsible for providing technical content. The Party responsible for each topic shall assemble, author, develop, coordinate, or otherwise produce the content for that topic as specified below and provide to the lead developer. Requirements as specified include requiring the applicable Contractors to author project-specific information in a consistent format in addition to submission of standard pre- printed manufacturer's O&M and product information.

C. Systems Manual Contractor Responsibilities: Contractor, Subcontractors and Vendors/Factory Representatives shall prepare, organize, and submit applicable content for the comprehensive and coordinated Systems Manual as specified below. Some of the material required from the Contractors will need to be authored or customized specifically for this project and facility. Contractor content is indicated by "CM" who is responsible for consolidating the content and materials from the various individual Contractors. Content for one system and all associated equipment must be organized and made in one submission. However systems may be submitted separately based on the progress of the project. Each submission shall be indexed as a sub-entity to the overall Systems Manual submission.

D. Division 22 and 23 Contractor Responsibilities: The Division 22 and 23 Contractor shall compile and organize the content for all work of Divisions 22 and 23 and provide one organized submittal. Upon approval by the CA, the content may be provided in multiple system and equipment-level submittals. Each submission shall be provided at least one month prior to the start of the Acceptance Period. This submittal will be reviewed by A/E, CA, Owner, and CM within two weeks of the submission. Contractor shall incorporate comments and corrections and resubmit prior to the start of the Acceptance Period.

E. Final Systems Manual Content Submittal: Within two weeks after Functional Completion, Contractors shall provide the final version of all Systems Manual information. Division 22 and 23 Contractor shall provide final version in one single submittal.

F. Maintenance and Updates of Systems Manual Content: Contractors shall maintain the applicable Systems Manual content throughout the Warranty Period. All hard copies will be retained at the Owner's facilities and electronically online through the Portal. Changes throughout the Warranty Period shall be fully coordinated with the CA. Maintenance of Systems Manual content shall include:

1. Changing any indicated settings, parameters, and other operational parameters that were changed by the Contractor during the Warranty Phase.
2. Changing any instructions as to procedures that needed to be changed during the Warranty Phase.
3. Changing the Record Schedules and/or Sequences of Operation if they were changed during the Warranty Phase.
4. Updating any Systems Manual content if changed or updated by the manufacturer.

G. Systems Manual Format and Submission: The Systems Manual contents shall be provided in hard copy and electronic format.

1. Electronic Version: The electronic version of the Systems Manual will be a series of files organized in subdirectories with a summary index with hyperlinks to the various documents and or references to separate CDs that contain the information. During authoring, sample format Microsoft Office documents (Word, Excel, or PowerPoint) will be provided to be used by vendors and contractors to provide the custom-authored content to the lead developer for final compilation. Electronic copies of the product data shall be in PDF format. Drawings shall be in AutoCAD or PDF format.
2. Electronic File Submissions. Electronic files of Systems Manual content may be posted to the project website. When a posting is made, emails shall be sent to the receiving Parties (and copied to any other interested Parties) stating that the submission has been posted. Posting should only include the current submission, although the Contractor shall maintain all versions of the submission and provide upon request. When electronic submissions are made on electronic media such as CDs, six copies of the electronic media shall be provided.

1.23 SYSTEMS MANUAL CONTENT AND ORGANIZATION

A. Systems Manual Scope: The Systems Manual format and content requirements shall be as follows. Documents developed or otherwise provided as specified in the Contract Documents should be used directly or referenced to the extent possible, including but not limited to OPR/BOD narratives, shop drawings, submittals, and O&M Manuals. Responsible parties are as indicated in square brackets; tasks not delineated by a responsible party are the responsibility of the lead developer.

B. Part 1 – Facility Information.

1. Directory of Entire Manual: Provide a directory indexing the entire set of documents that comprise the Systems Manual.
2. Contact Directory: Include the contact information for all contractors, subcontractors, vendors, manufacturers, and any other entity that has provided goods or services installed at the facility. Contact information should include name, website, address, phone numbers, and technical support phone numbers and email addresses.
3. General Facility and System Description: A/E Describe the function of the facility. Detail the overall dimensions of the facility, number of floors, foundations type, expected number of occupants, and facility category code. List and generally describe all the facility systems listed in Part II - Primary Systems Information and any special building features (for example, cranes, elevators, and generators). Include photographs, marked-up and labeled to show key operating components and the overall facility appearance.
4. Floor Plans: A/E Provide uncluttered, legible 11 x 17 inch floor plans. Exact copies of the design plans are usually not acceptable because of extraneous information. Include only room numbers, type or function of spaces, and overall facility dimensions on the floor plans. Do not include construction instructions, references, frame numbers, etc.
5. Utility Connection and Cutoff Plans: Provide utility site and floor plans that indicate the exterior and main interior connection and cutoff points for all utilities. Include enough information to enable someone unfamiliar with the facility to quickly locate the connection and cutoff points. Do not include items such as contour lines, elevations, and subsurface

information on the site plans. Indicate the room number, panel number, circuit breaker, valve number, etc., of each connection and cutoff point, and what that connection or cutoff point controls. These plans are in addition to the floor plans.

C. Part 2 - Primary Systems Operating Information.

1. This Part shall be organized by Division then system/subsystem using a systems approach. Part 2 contains system information, whereas Part 3 contains equipment information.
2. System Description: Provide a detailed discussion of the system composition and operation. Include technical details that are essential for an understanding of the system. A/E shall provide narratives to the CM who shall provide these to the major subcontractors for use in preparation of their required content. Also cross-reference O&M data contained in Part 4 and product data and submittals contained in Part 4.
3. Contact Information: Provide contact cross-references to the Parties applicable to the system being described and contained in the main Contact Directory in Part 1.
4. System Flow Diagrams : Provide a flow diagram indicating system liquid, air (do not include ductwork) or gas flow during normal operations. Integrate all system components into the diagram. Note that a compilation of non-integrated flow diagrams for the individual system components is not acceptable.
5. Diagrammatic Plans: Provide floor plans indicating the location of equipment and configuration of the system installation. Include the configuration of associated piping or wiring, subordinating structural features to utility features.
6. Start-Up and Shutdown Procedures: Provide step-by-step instructions to bring systems from static to operational configurations and from operating to shutdown status. Installing Contractor or Vendor/Manufacturer shall author this specifically for this project.
7. Normal Operating Instructions: Provide a discussion of the normal operation and control of the system. Address operating norms (for example, temperatures, pressures, and flow rates) expected at each zone or phase of the system. Supplement the discussion with control and wiring diagrams and data. Installing Contractor or Vendor/Manufacturer shall author this specifically for this project.
8. Emergency Operating Instructions: Provide emergency operating procedures in the event of equipment malfunctions. Provide shutdown instructions for fires, explosions, spills, or other contingencies. Installing Contractor or Vendor/Manufacturer shall author this specifically for this project. This content shall be in the context of the systems themselves and support the Emergency Operations manual to be created by the Owner.
9. Environmental Considerations: Provide a listing of the equipment that requires special operation, reporting, testing, analysis, or inspection to comply with federal, state or local environmental laws. Examples of possible list items include backflow preventer inspections, underground storage tank testing, hazardous material or waste usage/storage documentation and air pollution control devices. For each item, include requirements for environmental operation, reporting, testing, analysis, and inspection as well as references to respective implementing regulations, statutes or policies.
10. Equipment and System Training Documentation: Include documentation of training for applicable system. Include training agenda, all handouts and presentation materials/content. Reference existence and index of DVD or video tape recording.
11. Sequence of Operation/Control Schematic: Provide the written sequence of operation for the applicable system and the control schematic diagram.
12. Maintenance Service Agreements: Provide copies of maintenance service agreements where there pertain to systems involving multiple components and devices as indexed in Part 3.
13. Testing, Adjusting and Balancing Reports: Insert the TAB Reports provided under Section 230593 for the subject system.

D. Part 3 - Maintenance Manual.

1. Organize this section first by discipline then by equipment number or ID.

2. Maintenance Index: Provide a summary table that indexes the equipment requiring maintenance and indicates the frequency each piece of equipment needs attention, and a reference to the number of the Procedure associated with that frequency. CM shall provide Contractors with an Excel spreadsheet that will be completed by each applicable subcontractor and returned to the CM for incorporation in the Systems Manual.
3. Maintenance Information: Maintenance Information for each indexed entry shall contain the following:

    a. Equipment Data Sheet: Provide a summary of key nameplate and performance data.
    b. Procedures: Provide a 'Task Card' or step-by-step procedures for each individual maintenance procedure for a given frequency identified on the Maintenance Index. Include detailed PM procedures, safety instructions and precautions including Lock Out/Tag Out precautions, required skill level, number of personnel needed, frequency, special tools needed, parts needed and estimated time required to complete the task. These procedures shall be indexed in a manner approved by the Owner. These shall be provided as Microsoft Word files or scanned documents from the manufacturer's O&M Manual in either PDF or JPG formats).
    c. Field Test Reports: Provide any Field Test Reports that apply to equipment associated with the system.
    d. Troubleshooting Instructions: Provide detailed troubleshooting instructions indexed by common/expected symptoms. Alternatively, make specific reference to page in the manufacturer's O&M Manual where this information is provided.
    e. Extended Warranty Information: Include all warranties for products, equipment, components, and sub-components whose duration exceeds one year. Include warranties on components with the system they are contained within. Reference all specific operation and maintenance procedures that must be performed to keep the warranty valid.
    f. Special Tools: Provide a listing of any special tools required for servicing, diagnosis, or repair. Alternatively, reference specific page in the manufacturer's O&M Manual this information is provided.
    g. Supply Inventory Requirements: Provide a list of maintenance and repair supplies (e.g., spare parts, fuels, and lubricants) required to ensure continued operation without unreasonable delays. Identify and list parts and supplies that have long purchase lead times. Alternatively, reference specific page in manufacturer's O&M Manual that contains this information.
    h. Sources of Spare Parts: Include reference to contact information where spare parts can be obtained.
    i. Lubrication Schedule: Provide a lubrication schedule indicating types, grades, and capacities of lubricants for specific temperature ranges and applications. Alternatively reference the specific page in the manual that contains this information.
    j. Maintenance Service Agreements: Provide copies of maintenance service agreements where they pertain specifically to indexed equipment.
    k. Manufacturer's O&M Manual: Include manufacturer's printed O&M information. These shall be provided in PDF format. If unavailable as PDF from the manufacturer, hardcopy manual shall be scanned and provided as a single file.
    l. Application and Installation Instructions: Where applicable and separate from the O&M information, provide the Application and Installation Instructions that indicate how to correctly apply and install/setup the equipment.

E. Part 4 - Construction Documentation.

1. Record Drawings: Provide an index of all Record Drawings with drawing number, title, and electronic file name(s) including electronically referenced drawings.

2. Record Specifications: Provide a detailed index of the Record Specification. Include sections and major items in the specification all indexed to the appropriate page number.
3. Approved Product Data and Shop Drawings.

    a. Provide an index of all product data and shop drawings. This shall list all equipment with the associated submittal number.
    b. Organize and compile only APPROVED product data and shop drawings. Providing these in a filing format is acceptable provided all files are identified and organized for easy access.
    c. This information is required for this Part in its entirety regardless of inclusion in any other sections of the Systems Manual.

4. Commissioning Record: Provide complete Cx records including all Start-Up Documentation and Functional Performance Test documentation.

F. Part 5 – Preventative Maintenance / Recommissioning Manual.

1. Preventative Maintenance Specification: Specification for day-to-day maintenance of the facility, including operating log requirement, reports, and preventative maintenance tasks for each system, including recommended inspections, and tests.
2. Recommissioning Test Log: Blank testing plan for future use in recommissioning.

1.24 EXISTING SERVICES INTERRUPTIONS

A. Contractor shall exercise great care in the connection to or interruption of existing functional services (utilities, systems, spaces, etc.) that support the facility. This shall only be done with advance notification, completion of appropriate Owner's documentation to obtain approval, and final approval and supervision by the Owner.

B. Refer to applicable Division 01 sections for logistics and requirements for connection to or interruption of existing services.

C. All events where an existing service will be connected to or interrupted shall be itemized as a milestone or task in the construction Cx schedule. Owner will not approve the connection or interruption unless the event has been forecasted for at least three months. The schedule will not serve as the final notification but will support planning.

D. Final notification shall be per the Owner's process with all forms and submissions complete and accurate. Owner shall provide information on processes and applicable forms on request.

E. Depending on the service, Owner may dictate that the interruption be during non-working hours. In other cases, Owner will require the interruption be during working hours so mission can be monitored.

F. Contractor shall summarize the potential impact and the maximum duration.

G. Owner reserves the right to cancel the connection or interruption at any time if it circumstances necessitate this. The Owner also reserves the right to constrain the extent of any interruption.

H. Connections to Hydronic Systems:

1. Connections to existing hydronic systems shall be done only on mutual written approval of both parties to the connection. Owner and Contractor shall review the fluid and piping

condition and any applicable treatment and/or water analyses of the other parties system and agree to the connection.

2. Contractor shall work with the Owner to ensure the balance of the existing hydronic system is not affected to the extent that it will affect mission. Therefore, the Contractor shall attempt to plan connections or interruptions for times when the impact will be the least.
3. Contractor shall record the balance of the existing system before and after the connection to document the impact. Balancing adjustments of the combined system shall commence immediately upon connection unless approved otherwise by the Owner.
4. Contractor shall work with the Owner to ensure any applicable pumps do not overload or become dead headed.

I. Connections to Air Systems:

1. Connections to existing air systems shall be done only on mutual written approval of both parties to the connection. Owner and contractor shall review the air quality, inlets and ductwork condition and any applicable filtration of the other party's system and agree to the connection.
2. Contractor shall work with the Owner to ensure the balance of the existing air system is not affected to the extent that it will affect mission. Therefore, the Contractor shall attempt to plan connections or interruptions for times when the impact will be the least.
3. Contractor shall record the balance of the existing system before and after the connection to document the impact. Balancing adjustments of the combined system shall commence immediately upon connection unless approved otherwise by the Owner.
4. Contractor shall work with the Owner to ensure any applicable pumps do not overload or become dead headed.

J. Connections to Electrical Systems:

1. Connections to existing electrical systems shall be done only on mutual written approval of both parties to the connection. Owner and Contractor shall review breaker/fuse settings, short circuit studies, the load on the system, and condition of the electrical systems and equipment of the other party's system and agree to the connection.
2. Contractor shall work with the Owner to ensure the loading and coordination of settings are such that the connection will not affect the mission. Therefore, the Contractor shall attempt to plan connections or interruptions for times when the impact will be the least. Contractor shall complete and document all interrupter settings and transfer switch timing per the short circuit study and design intent prior to the connection.
3. Contractor shall record the loads on the existing system before and after the connection to document the impact. Interrupter adjustments on the combined system shall commence immediately upon connection unless approved otherwise by the Owner.
4. Contractor shall work with the Owner to ensure any applicable distribution or generation equipment do not overload.

PART 2 - PRODUCTS

2.01 INSTRUMENTATION

A. General: All testing equipment used in the Cx process shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.

B. Standard Testing Instrumentation: Standard testing instrumentation normally used for performance assessment and diagnosis will be provided by the CA. Refer to Sections 230800 and 260800 for a list of applicable test equipment.

C. Special Tools: Special equipment, tools and instruments (only available from a vendor, and specific to a piece of equipment) that are required for testing equipment in accordance with these Contract Documents shall be included in the base bid price to the Contractor and turned over to the Owner upon completion of the project.

2.02 TEST KITS FOR METERS AND GAUGES

A. Test kits for meters and gauges shall be provided to the Owner new and in good condition. Previously used test kits will be unacceptable. Kits shall be submitted prior to the Acceptance Phase. Kits required are specified in the individual technical specifications and in 230800 and 260800.

PART 3 - EXECUTION

3.01 GENERAL STARTUP STANDARD OF CARE

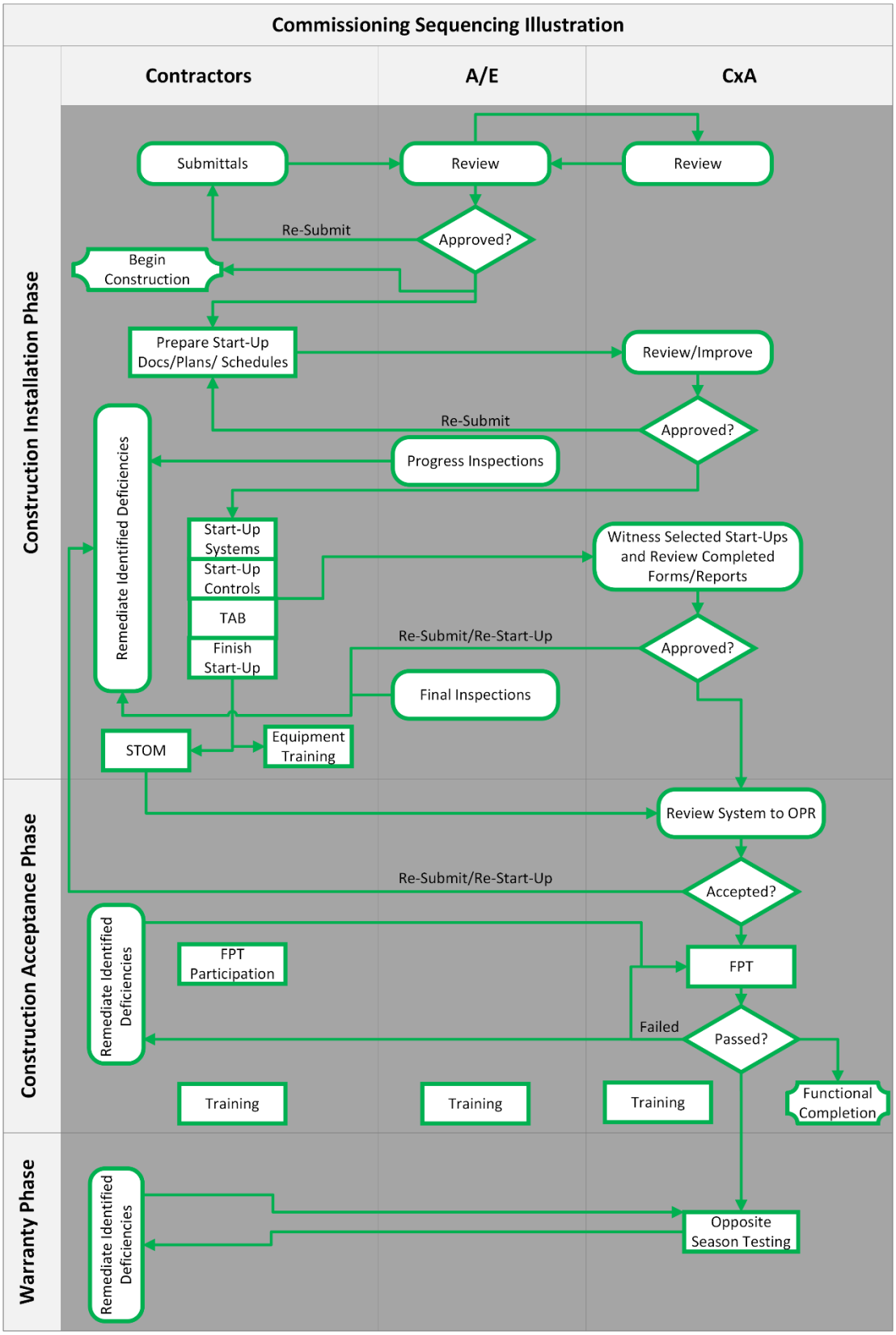
A. Procedures that establish a minimum Standard-of-Care for the start-up, checkout and testing of applicable equipment are specified in the individual technical specifications, each commissioning section and in Section 019110. Contractor shall apply this Standard-of-Care and document per the Cx requirements.

3.02 FUNCTIONAL PERFORMANCE TESTING

A. Functional Performance Testing procedures are specified in Section 019110. Contractor shall participate in the development and approval of the testing procedures, as well as participate as required in the initial sample of tests as indicated herein.

3.03 WORK SEQUENCE ILLUSTRATION

A. See next page:



END OF SECTION 019100

SECTION 019110 – GENERAL COMMISSIONING REQUIREMENTS FOR FUNCTIONAL PERFORMANCE TESTING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Functional Performance Testing (FPT or 'testing') of systems.

B. Documentation of FPTs.

C. Acceptance criteria.

1.02 SCOPE

A. This section describes the Functional Performance Testing (FPT) process, procedures, and requirements. It is intended to illustrate (i) the Contractor's requirements for assisting the Commissioning Authority (CA) with the Functional Performance Testing of systems, and (ii) to demonstrate the level at which systems and equipment will be tested prior to being deemed 'Acceptable' to the Owner.

B. The CA will prepare itemized and detailed FPT plans and procedures that:
1. Specify individual tests and procedures that meet the general requirements of the Cx Plan and commissioning (Cx) process;
2. Serve to document and record the testing procedures and the results of the tests.

C. The Contractor shall provide technical input to the CA as needed during the development of the final project FPTs.

D. Example (referred herein to as 'generic') FPTs are provided as illustration for the Contractors to represent the level of detail to which FPTs will be conducted.

1.03 RELATED WORK AND DOCUMENTS

A. The Cx process references many related Sections, particularly Section 019100 - General Commissioning. It is important for all Contractors subject to the Cx process to be familiar with Section 019100.

B. Refer to Section 019100 for a complete list of Sections on Related Work.

1.04 DEFINITIONS AND ABBREVIATIONS

A. Refer to Section 019100 for a complete list of Definitions and Abbreviations. This paragraph includes a comprehensive list of acronyms describing the various required Parties referred to in the Section for individual FPTs.

1.05 REFERNCE STANDARDS

A. Refer to Section 019100 for a complete list of Reference Standards.

B. FUNCTIONAL PERFORMANCE TESTING

C. Objectives and Scope: Systems shall be tested to ensure proper operation through all modes of operation including normal expected operation, maintenance operation as well as proper response to system and component failures that are considered abnormal operation as indicated below.

1. Normal Operation: Each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. These series of tests will demonstrate that the systems and equipment operate throughout typical operation including normal adjusting, cleaning, media replacement, and maintenance.
2. Abnormal Operation: Test each system to simulate possible abnormal conditions and verify proper responses to such modes and conditions as power failure, equipment and component failure, freeze condition, deviation of operating parameters outside of normal, no flow, supporting utility failure, human error, etc. Abnormal operation tests shall demonstrate proper and safe response to the subject systems and the other systems that it affects or integrates with. These tests shall also demonstrate proper enunciation of abnormal conditions to quickly and effectively notify users and operators of such condition. Specific modes required in this project are given in this section and any other sections where test requirements are found.

D. Development of Test Procedures: CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Prior to execution, the CA shall provide a copy of the test procedures to the Contractor who shall review the tests for feasibility, safety, equipment and warranty protection, and scope. The CA will also submit the tests to the A/E for review.

1. Contractor shall review the FPTs in detail and approve them.
2. The CA shall review Owner-contracted testing, factory testing, or required Owner acceptance tests for which the CA is not responsible to oversee. Review shall include content, scope, and documentation format, and shall determine what further testing or format changes may be required. Redundancy of testing shall be minimized.
3. The purpose of any given specific FPT is to verify and document compliance with the stated criteria of acceptance.

E. Scheduling: Owner shall schedule the Functional Performance Testing after system 'Turn-Over' occurs (Turn-Over or STOM is the official Contractor notification that systems have completed Start-Up and are ready for testing with all required submissions and reviews of all the required submittals has occurred). To the extent practical, tests shall be scheduled to allow efficient and contiguous testing of inter-related systems and equipment.

F. Participation: CA will direct and conduct Functional Performance Tests after Start-Up Documentation of systems and equipment has been reviewed and accepted and system 'Turn-Over' occurs. Conceptual procedures for the Functional Performance Testing are outlined elsewhere in this Section. CA will execute the FPTs unless otherwise specified. Contractor shall assist as described above with manipulation of the systems or equipment, provision of supporting equipment or materials (lifts, ladders, specialty test equipment, safety equipment), and on-the-spot remediation of minor identified deficiencies whenever possible. Required participation is outlined in the generic FPTs provided elsewhere in this Section.

1. Any Cx Team member may attend any FPT. Required Parties are as described below.
2. Required participating Parties shall be indicated with the individual FPT. Typically, multiple Parties are required for any given test, yet participation for any given Party is only required for the respective portion of the test for which the Party is responsible. For instance, BAC does not have to be present for capacity testing of an air handler, only the control-related portion of the test. In many cases, the maximum required time in hours is indicated in parenthesis for any given test. The time is typically per unit system unless indicated otherwise (i.e.: 1-hr per air handler tested). If no time is indicated, participation is required throughout the entire test.
3. Frequently, on multiple samples where a given Party does not directly conduct the test, the participation of that Party will only be required for an initial quantity of systems/equipment. Whenever practical and at the discretion of the CA, the CA will continue with the remaining portion of the sample without assistance from the Contractor. In this case the time requirement will be indicated as total. However, the Contractor is allowed to be present at their option for any or all FPTs conducted.
4. It is required that the required Parties be available on-site throughout the testing of any given system for which they are required participants. Therefore, time for which they are not directly involved can be spent performing other work (typically addressing identified punch list items or failed tests).
5. No Party involved with the project is prohibited from participation in or witnessing of any tests. Any Contractor may elect to witness all tests on their systems even if their involvement is not directly required (for instance, BAC involvement is sometimes required on the first few of a sample and not on the entire sample).
6. CA will endeavor to coordinate effectively with the individual Contractors throughout FPT and minimize their required involvement.
7. Contractor assumes responsibility for damage to systems conducted in accordance with the approved procedures.

G. Detailed FPT Development and Contractor Review: CA will prepare detailed and itemized testing procedures to define and document the FPT. These will typically be developed during the Construction Phase and completed during the Acceptance Phase. The CA shall submit these procedures to the Contractor for review. Contractor shall indicate all required limitations, safety procedures, maximum thresholds, and any other parameters during the FPT development. Contract shall be responsible for any damage to the equipment caused by Functional Performance Testing done per the procedures and within the limitations of the approved procedures.

H. Completeness: All systems must be completed and ready for FPT. All Start-Up Documentation, factory-authorized field testing, independent testing agency tests, and TAB procedures must be complete and the control systems must be tested and started for the respective system or component.

I. Test Documentation: CA will conduct tests, and/or witness tests as applicable. CA will record all test results on the forms developed for the testing. CA will ‘Pass’ or ‘Fail’ the testing and record the date and time of the test. Deficiencies shall clearly be indicated when the test is failed. When all related testing is completed successfully, CA shall recommend acceptance of the system or component.

J. Deficiencies and Retesting: When deficiencies are identified during testing, depending on their extent or magnitude, they can be corrected during the test and the testing can continue to successful completion. More significant deficiencies will require failure of the test and re-testing. Deficiencies of this magnitude will result in an Action Item on the Action List. The resolution of the deficiency will then subsequently be tracked by the CA via the Action List. All tests shall be repeated until successful completion. Refer to more specific provisions below.

K. Sampling: Some types of identical equipment (such as terminal devices) will be tested using a sampling strategy. The sample percentage is indicated in the generic FPT provided elsewhere in this Section.

L. Max Failure Limit and Sample Percentages: A 'Maximum Failure Limit' is indicated along with the 'Sampling Percentages'. The Max Failure Limit indicates the maximum percentage of the tested devices that may have any test that fails before an entirely new sample must be tested. This is based on the concept that if many failures occur, it is a result of inadequate start-up by the Contractor. When the maximum number of failures is reached, testing on that sample will be terminated and re-testing will be scheduled.

1. If no Max Failure Limit is indicated, all tested samples must pass (Max Failure Limit = 0%).
2. Where sample tests involve multiple systems (i.e., checking strainers on different hydronic systems), the Maximum Failure Limit will apply per system.
3. The responsible Contractors shall pay the CA cost of that sample test, and redo the startup/TAB for the applicable devices/systems.
4. All work necessitated by sample failures shall be at no cost to the Owner.

M. Opposite Season Testing: Testing procedures shall be repeated and/or conducted as necessary during appropriate seasons. Opposite Season testing will be required where scheduling prohibits thorough testing in all modes of operation. Air handler and central heating system testing for heating-related modes of operation and control loops shall be tested during outside air temperatures below 40 °F.

N. Approval. The CA passes each test and subsequently recommends approval to the Owner who reviews and approves the FPT.

1.06 COORDINATON BETWEEN TESTING PARTIES

A. Factory Start-Ups: For many systems and equipment, Factory Start-Ups are specified. These Factory Start-Ups will be reviewed and checked during Functional Performance Testing. All costs associated with the Factory Start-Ups are included with the bid unless otherwise noted. Contractor shall make notification of when Factory Start-Ups are occurring and coordinate these with witnessing Parties. The CA and other Cx Team members may witness Factory Start-Ups at their discretion. Aspects of Functional Performance Testing accomplished during the Factory Start-Ups may be accomplished and approved by the CA if they meet the intent of the FPT.

B. Independent Testing Agencies: For systems where Independent Testing Agencies are specified, the cost of this testing shall be included with the bid unless otherwise noted. Much of the testing performed by Independent Testing Agencies will cover aspects required in the Start-Up Documentation and Functional Performance Tests.

1. Contractor and testing agencies shall coordinate with the CA so that the CA can witness the testing and approve the applicable aspects of the FPTs.
2. The CA may in some cases independently spot-check work of the testing agencies if the tests were not witnessed. However, it is not the intent for the CA to re-accomplish testing by others that is specified in the construction specifications. For instance, much of the testing requirements for the electrical systems will be performed by the independent electrical testing agency provided under the bid. The CA shall witness the indicated sample of the testing and record the results in the record of Functional Performance Tests.
3. Contractor is responsible for coordinating the efforts of testing agency with that of the Cx process. Documentation shall be contiguous and seamless and duplication should be avoided. Testing agencies shall complete the documentation of the Cx process as required.

C. Specialized Testing by Contractor: Where Specialized Testing is specified in the technical specifications, the Contractor, subcontractor, vendor, or factory representative as applicable shall conduct the Specialized Testing and provide all specialized instrumentation and equipment. CA and other Cx Team members may witness tests at their discretion. The CA may in some cases independently spot-check the results of the tests if the tests were not witnessed. However, it is not the intent for the CA to re-accomplish testing that is specified in the construction specifications. All Specialized Testing procedures shall be integrated with the Cx process and all documentation shall be coordinated and integrated with the documentation of the Cx process. Examples of Specialized Testing include but are not limited to:

1. Generator load testing (not including building power outage testing which will be administered by CA).
2. Acceptance testing of the fire alarm system.
3. Fire suppression system hydraulic tests.
4. Electrical system testing per NETA.
5. Uninterruptible Power Supply.

1.07 FPT ACCEPTANCE CRITERIA

A. The Acceptance Criteria shall be as follows unless more specifically indicated within individual tests. CA may exercise professional judgment to relax requirements and pass tests and recommend approval when appropriate.

1. Capacity: Capacity and/or equipment performance will generally be as specified ±5%.
2. Efficiency: Efficiency where specifically indicated in the documents will be ±5%. When inferred from manufacturer's catalogue data, criteria will be ±10%.
3. Balancing: Balancing-related criteria will be ±5% for water and ±10% for air.
4. Accuracy: Accuracy/repeatability on sensing devices will be as specified for the device. CA and TAB will use calibrated gages for independent validation and use judgment in passing or failing the devices. In many cases, the coordination of multiple related sensors is more important than absolute accuracy.
5. Controls: Control feedback loop response and setpoint deviation criteria will be as specified in Sections 230800.
6. Sequences: HVAC sequence-related criteria will be as explicitly specified in the documents and as interpreted by the CA. Code required sequencing shall be per the applicable code.
7. System sequences shall be as required by the approved shop drawings.
8. Motor Phase Imbalance: Shall be no more than 2% (Amps and Volts).
9. Noise Levels:
    a. Occupied Spaces: As indicated in the Owner's Project Requirements or Basis of Design (OPR/BOD) document. Otherwise, noise level shall be as recommended in the most current version of the ASHRAE Handbooks for the applicable occupancy.
    b. Max 77dBa at 3' from a UPS.
    c. Max 65dBa at 7' from an Engine Generator Set.
    d. At limits of the enterprise or facility: As required by current local ordinances.
10. Indoor Environmental Parameters (T, RH, CO2, VOC): Shall be as indicated in the Basis of Design document. Otherwise, as recommended in the most current version of the ASHRAE Handbooks for the applicable occupancy.
11. Air Pressurization: As indicated in the OPR/BOD document. Otherwise, as indicated in the most current version of the ASHRAE Handbooks for the applicable occupancy. Smoke/shaft pressurization shall be as required by NFPA to maintain maximum door opening forces and to restrict the passage of smoke.

12. Indoor Lighting Levels: As indicated in the OPR/BOD document. Otherwise, as recommended in the most current version of the IES Handbooks for the applicable occupancy.
13. Electrical Systems: Shall be in accordance with manufacturer's recommendations of individual components and devices, NFPA 70B and International Electrical Testing Association (NETA) testing specifications NETA ATS-Latest Version.
14. Inter-system interfaces and coordination: As specified and generally to ensure safe, reliable, and robust operation.

PART 2 - PRODUCTS

2.01 INSTRUMENTATION

A. General: All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance within the tolerances specified. All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available. Supplier of instrumentation shall submit the calibration certificates along with the startup documentation.

B. Standard Testing Instrumentation: Standard instrumentation normally used for performance assessment and diagnosis will be provided by the CA for tests being conducted by CA. All other instrumentation shall be provided by the Contractor. The instrumentation to be provided by the CA includes:

1. Electronic manometer (for air and flow hood).
2. Electronic manometer (for water).
3. Temperature instruments and gauges.
4. Humidity instruments and gauges.
5. CO2 instrument.
6. Sound meter.
7. Light level meter.
8. Electronic multimeter.
9. Receptable tester.

C. Special Tools: Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and provided to the Owner.

1. Provide a temporary license to software needed to access the BAS at both the terminal equipment and on the primary LAN/at primary controllers. Provide all configuration utilities needed to read all parameters and set up terminal boxes. Provide temporary graphic interface software license for use during the Acceptance Phase.

PART 3 - FUNCTIONAL PERFORMANCE TESTS (SYSTEMS AND EQUIPMENT RELATED)

3.01 PREREQUISITES

A. All equipment, components, and devices applicable to the FPT must be started and operational and systems must have completed a STOM successfully or be 'Turned Over' to the Cx Team. This includes completion of Start-Up Documentation, pressure testing of equipment, duct, piping;

flushing/cleaning of applicable systems; completed labeling and identification; completed insulation of applicable systems; and all other requirements for placing system into dynamic operation.

B. Unless specifically agreed upon by the Owner and CA, all support systems shall be complete prior to FPT. For instance, an air handler will require that:

1. The electrical system serving it is completed and tested;
2. The hydronic systems serving it have been pressure tested, flushed, and functional performance tested;
3. Balancing has been accomplished on the air and water sides;
4. The control systems have been started and calibrated.

C. The CA shall determine the optimal sequence of testing.

3.02 FUNCTIONAL TESTING PROCESS

A. Functional Performance Testing ('Functional Testing') on any given system shall typically begin with testing device-level elements such as sensors and actuators; progress to component-level assemblies of devices; then to system-level, then to inter-system level, then to building-level.

B. Functional Testing of systems shall generally proceed from the utilities to the central systems, to the distribution systems, to the zone terminal units and services. CA shall plan this process and communicate it through a precedent diagram (in Gantt or Pert format). Construction Manager shall reflect that process in the Construction Schedule. Subcontractors shall perform work in accordance with the schedule.

3.03 COMMON ELEMENTS FOR ALL SYSTEMS

A. Required submittal documentation shall be present and located convenient to testing area. Validate that all required documentation has been submitted and is per the contract requirements.

B. Contractor shall provide the completed Start-Up Documentation and shall follow Turn-Over procedures as specified in Section 019100. CA shall review the Start-Up Documentation and spot-check the installation prior to or at the beginning of the FPT.

C. Contractor shall demonstrate that access is sufficient to perform required maintenance.

D. BAS trends shall have been established as required in the documents. These shall be available for review prior to or during the FPT.

E. All dynamic systems powered by electricity shall be tested to simulate a power outage to ensure proper sequencing. Those on emergency power or uninterruptible power shall be tested on all sources.

F. Capacities and adjusted/balanced conditions as applicable shall be subject to check.

G. Sequencing Verification: All modes of operation and actions shall be verified for equipment/system samples.

H. System and equipment configurations shall be compared against the contract documents.

I. Verify functions (such as heating and cooling) are coordinated and do not overlap or 'fight'.

J. All adjusted, balanced, controlled systems shall be assessed to determine the optimal setting for the system as applicable. The optimal settings should be determined to establish reliable, efficient, safe and stable operation.

K. BAS or Local Panel Dynamic Graphics: The graphic displays for all components, systems, and areas required to be represented by a BAS graphic shall be checked for adequacy and accuracy. Furthermore, when setpoints or other parameters are required to be adjustable, CA shall verify that they can be adjusted directly from the graphic screen.

L. Emergency power tests for mechanical systems will be conducted in concert with the testing of the emergency power systems. Mechanical contractor shall be available for the power outage test to test mechanical systems under a power outage. This is in addition to the requirements specified for the mechanical system.

M. Where system and zones are designed for various modes of operations, test representative systems in all modes of operation. This includes:

1. Seasonal Modes.
2. Sequencing Modes.
3. Emergency Modes.

3.04 TAB VERIFICATION OF MECHANICAL SYSTEMS

A. CA shall review TAB reports.

B. Participants shall include: CA, Owner's Representative, and TAB.

C. The CA will select up to 10% of the readings from the Balancing Reports and spot-check them. The maximum failure rate for this sample is 10% and the system shall be re-balanced and re-documented if this rate is exceeded. The readings selected by the CA may include supply air diffuser readings (both minimum and maximum readings for VAV boxes), main and branch supply duct traverse readings, outside/return air flow readings, exhaust air flow readings, water flow readings, amp readings, and water pressure drop readings through coils, heat exchangers, and other hydronic elements. For all readings, a deviation of more than 10% between the verification reading and reported data shall be considered as failing the FPT. All readings that fail the FPT shall require re-balancing.

3.05 HVAC SYSTEM PUMPS

A. Participants shall include: CA, MC (1), TAB (1), and BAC (1) (BAC only where pumps are automatically controlled).

B. Sample: 50%; max failure limit: 20%.

C. FPT shall include 'Common Elements for All Systems' (above) to the extent applicable.

D. CA shall review Start-Up Documentation and TAB report.

E. Contractor shall demonstrate that strainers are clean.

F. CA shall spot-check Start-Up Documentation.

G. Pumps shall be manually started individually. Pressure differential, kW (or slip on the motor), and flow shall be checked at shut-off, wide open, and balanced (or controlled) condition. Typically, the reading from the instrumentation provided with the pump (thermometers and pressure gages and flow meters as applicable) will be acceptable if used to validate an action as opposed to checking balancing.

H. For pumps designed with automatic starting of back-up pumps upon primary pump failure, test shall include (1) Enable automatic controls; (2) Start primary pump; (3) Open disconnect switch of primary pump; and (4) Validate that standby is energized. This test shall be performed on all pumps.

I. For variable speed pumps, manipulate control valves to change flow conditions and observe control response. Ensure stable control response to step-change in flow conditions. Check for the applicable acceleration and deceleration of the pumps. Manually ramp the pump speed from minimum to maximum speed to ensure stable operation of pumps and record/defeat any critical frequencies. Record representative part-load output from the drive (using VSD read out). Check calibration of control input. Check drive bypass operation if applicable.

J. Simulate power outage and ensure orderly and automatic restart.

3.06 HYDRONIC DISTRIBUTION SYSTEMS

A. Participants shall include: CA, MC (1).

B. Sample: All systems, 20% (of strainers), Max Failure Limit: 5%.

C. FPT shall include ‘Common Elements for All Systems’ (above) to the extent applicable.

D. Check system make-up and pressurization. Record optimal settings. Ensure air is removed by bleeding the sample rate of coils or high points. Ensure expansion tanks are properly charged.

E. CA shall review Start-Up Documentation, pressure test documentation, and TAB report.

F. Refer to ‘HVAC Systems Pumps’ for pump testing. Additionally, establish a trend on the pump control loop. Observe normal control function. Introduce one setpoint step-change and observe response.

G. Verify sequencing of all pumps. Simulate pump failure and restart, pumps capacity stage up and stage down as applicable, and automatic rotation of lead/priority.

H. Blow off selected strainers to ensure the system is flushed and clean.

I. Verify or spot-check TAB results (Refer to ‘TAB Verification of Mechanical Systems’)

J. Simulate and observe maximum and minimum loading conditions on the system from a flow and thermal perspective.

3.07 VARIABLE SPEED DRIVES (VSD)

A. Participants shall include: CA, MC (2), BAC (2), EC (1). Additional time is generally included with the systems that include the drives.

B. Sample: 50%; max failure limit: 20%.

C. FPT shall include ‘Common Elements for All Systems’ (above) to the extent applicable.

D. CA shall review Start-Up Documentation.

E. Verify the overload protection.

F. Test the operation of the controller local and remote start/stop and speed control. Spot-check insulation resistance on the controller bus and control circuits.

G. Validate VSD setup parameters are coordinated with motor application.

H. Validate VSD acceleration and deceleration rates on start and stop.

I. Verify ranging of control input and coordination with that displayed on Operator Interfaces.

J. Verify ‘Bypass’ functionality where applicable.

K. Verify restart after power outage.

L. Verify any ‘Skipped Frequencies’ are programmed and recorded.

M. Verify alarming and shutdown sequences.

N. Conduct insulation resistance, short circuit, and ground tests of motors.

3.08 AIR-COOLED CHILLER

A. Participants shall include: CA, MC (1), TAB (1), and BAC (2).

B. Sample: 100%.

C. FPT shall include ‘Common Elements for All Systems’ (above) to the extent applicable.

D. Enable the chiller and associated equipment and control system and increase the load on the chilled water system by starting the air handling units, fan coil units, etc.

E. Verify that flow is established by the chilled water proof-of-flow switch or device.

F. Verify the chiller start sequence.

G. Verify operation of the air-cooled condensing unit and associated components.

H. Verify functioning of ‘soft start’ sequences, record motor amperage as a time function.

I. Record chiller amperage and voltage at full load and part load conditions. Confirm that the control system calculates the chiller load and provides a trend log of the load imposed.

J. Verify the chiller shutdown sequence occurs properly when loads are removed from the chilled water system.

K. Verify the operation of the chilled water pumps and the air-cooled condensing unit when the loads are restarted on the chilled water system.

L. Verify proper stage-up and stage-down sequence of multiple chillers. Check for excessive chiller cycling at part load for chillers with staged capacity control.

M. Check capacity and efficiency of the chiller.

N. Check calibration of remote current limit or remote setpoint indication.

O. Verify proper suction, head, and oil pressures.

P. Verify the rotation and re-prioritization of the chillers per the sequence.

Q. Simulate power outage and ensure automatic and orderly restart.

3.09 PRIMARY CHILLED WATER SYSTEM

A. Participants shall include: CA, MC (1), TAB (1), and BAC (8).

B. Sample: 100%.

C. FPT shall include 'Common Elements for All Systems' (above) to the extent applicable.

D. CA shall review Start-Up Documentation and TAB reports.

E. Verify the cooling enable/disable sequences.

F. Verify proper stage-up and stage-down of the chillers by the control system as load is varied. Load can be varied by manipulating valves, starting/stopping chilled water terminals and/or changing the staging control parameters.

G. Verify proof and enunciation of individual chillers upon failure. Simulate failures that cause both an automatic reset of the chiller (typically temporary condenser water flow loss) and manual reset of the chillers. Verify that chiller requests are removed appropriately and the next chiller in rotation is energized.

H. Refer to 'HVAC Systems Pumps' for pump testing. Additionally, establish a trend on the pump control loop. Observe normal control function. Introduce one setpoint step-change and observe response.

I. Verify rotation and/or re-prioritization of multiple chillers as applicable, whether manual or automatic rotation is employed.

J. Ensure the static pressure setting of the make-up water system is coordinated and that the entire system is under positive pressure throughout all modes of operation.

3.10 PRIMARY HEATING SYSTEM

A. Participants shall include: CA, MC (2), TAB (4), and BAC (8).

B. Sample: 100%.

C. FPT shall include 'Common Elements for All Systems' (above) to the extent applicable.

D. CA shall review Start-Up Documentation and TAB reports.

E. Verify the heating enable/disable sequences.

F. Verify proper stage-up and stage-down of the boilers by the control system as load is varied. Load can be varied by manipulating valves, starting/stopping hot water terminals and/or changing the staging control parameters.

G. Verify proof and enunciation of individual boilers upon failure. Verify that boiler requests are removed appropriately and the next boiler in rotation is energized.

H. Verify rotation and/or re-prioritization of multiple boilers as applicable, whether manual or automatic rotation is employed.

I. Ensure the static pressure setting of the makeup water system is coordinated and that the entire system is under positive pressure throughout all modes of operation.

3.11 HOT WATER BOILER

A. Participants shall include: CA, MC (1), TAB (1), and BAC (2).

B. Sample: 100%.

C. FPT shall include 'Common Elements for All Systems' (above) to the extent applicable.

D. CA shall review Start-Up Documentation and TAB report.

E. Contractor shall start and warm-up the boiler.

F. Verify that burner modulates/stages to maintain water temperature.

G. Verify proper operation of makeup water system, including chemical treatment, flow regulation, and other parameters.

H. Observe combustion efficiency tests conducted by the Contractor for boiler at full load and part load conditions.

I. Verify combustion controls, fuel rate input and range, flame failure cutouts, gas train safeties, and other firing controls.

J. Check for gas leaks.

K. Test all applicable safeties and verify remote enunciation.

L. Simulate power outage and ensure automatic and orderly restart.

3.12 AIR HANDLING UNIT

A. Participants shall include: CA, MC (2), TAB (4), and BAC (8). Hours indicated are for first of each AHU type for all Parties.

B. Sample: 50%, Max Failure Limit: 10%.

C. FPT shall include 'Common Elements for All Systems' (above) to the extent applicable.

D. CA shall review Start-Up Documentation and TAB reports.

E. Verify automatic start/stop of fan and open/close of outdoor air damper(s).

F. Start heating and cooling system, manipulate control device to obtain maximum cooling and heating. Measure temperatures and pressures to determine capacity.

G. Weather permitting, cause all applicable modes of operation using false loading where practical. Check proper sequence for switching modes and proper operation within a mode.

H. Check calibration of control devices and for stable control response and component performance including chilled water coils, hot water coils, steam coils, humidifiers, economizer cycles, and others. Ensure proper coordination of control loops and that no fighting or energy wastes result.

I. Check for free and adequate flow of cooling coil condensate.

J. For variable speed fans, manipulate air terminal units to change flow conditions and observe control response. Ensure stable control response to step-change in flow conditions. Manually ramp fan speed from minimum to maximum to ensure stable operation of fans. Record representative part load output from the drive. Check calibration of control input. Check drive bypass operation if applicable.

K. For fans with inlet vanes, manipulate air terminal units to change flow conditions and observe control response. Ensure stable control response to step-change in flow conditions. Manually modulate vanes from minimum to maximum to ensure stable operation of fans. Record representative part-load power draw on the motor. Check calibration of control input.

L. Ensure minimum required ventilation rates are maintained across the full range of control (where applicable).

M. Test all interfaces with the fire alarm system and all smoke control sequences.

N. Verify interlocks with exhaust fans where applicable.

O. Test proof alarming where applicable.

P. Test operation of applicable safeties including freezestats, high and low static devices, smoke detection, duct humidity, and others. Check AHU component status in each event.

Q. Check system status and operation in the Off, Unoccupied, and Occupied modes of operation. Validate proper start up and shut down sequences.

R. Test all ‘Fireman Control and Override’ sequences.

S. Simulate power outage and ensure automatic and orderly restart.

3.13 FAN COIL UNIT

A. Participants shall include: CA, MC (2), TAB (2), and BAC (2).

B. Sample: 20%, Max Failure Limit: 10%.

C. FPT shall include ‘Common Elements for All Systems’ (above) to the extent applicable.

D. CA shall review Start-Up Documentation and TAB reports.

E. Verify automatic start/stop of fan and open/close of outdoor air damper.

F. Start heating and cooling systems, manipulate control device to obtain maximum cooling and heating. Measure temperatures and pressures to determine capacity.

G. Weather permitting, cause all applicable modes of operation using false loading where practical. Check proper sequence for switching modes and proper operation within a mode.

H. Check calibration of control devices and for stable control response.

I. Check for free and adequate flow of cooling coil condensate.

J. Simulate power outage and ensure automatic and orderly restart.

K. Verify changeover for two-pipe systems as applicable.

3.14 FAN/AIR SYSTEM (GENERIC)

A. Participants shall include: CA, MC, TAB, and BAC.

B. Sample: 30%, Max Failure Limit: 10%.

C. FPT shall include 'Common Elements for All Systems' (above) to the extent applicable.

D. CA shall review Start-Up Documentation and TAB reports.

E. Verify start/stop control sequences.

F. Check the capacity of the fan at maximum conditions.

G. Cause all applicable modes of operation using false loading where practical. Check proper sequence for switching modes and proper operation within a mode.

H. For variable speed fans, manipulate air terminal units to change flow conditions and observe control response. Ensure stable control response to step-change in flow conditions. Manually ramp fan speed from minimum to maximum to ensure stable fan operation. Record representative part-load output from the drive. Check calibration of control input. Check drive bypass operation if applicable.

I. For fans with inlet vanes, manipulate air terminal units to change flow conditions and observe control response. Ensure stable control response to step-change in flow conditions. Manually modulate vanes from minimum to maximum to ensure stable operation of fans. Record representative part-load power draw on the motor. Check calibration of control input.

J. Verify interlocks with exhaust fans where applicable.

K. Test all interfaces with the fire alarm system and all smoke control sequences.

L. Test proof alarming where applicable.

M. Simulate failures of fans and ensure proper start-up of backup fans.

N. Test operation of applicable safeties including freezestats, high and low static devices, smoke detection, duct humidity, and others.

O. Simulate power outage and ensure automatic and orderly restart.

3.15 BUILDING AUTOMATION SYSTEM (BAS)

A. Participants shall include: CA and BAC (Time is typically included in the individual systems. However, an additional 8 hrs. shall be for workstation and administrative aspects.)

B. Refer to Section 238060 for BAS Commissioning requirements.

C. FPT shall include 'Common Elements for All Systems' (above) to the extent applicable.

D. CA shall review Start-Up Documentation.

E. Controls system sampling will typically correspond to the sampling rate of a system or piece of equipment. These sampling rates are indicated above for the respective item.

F. Operate the equipment and subsystems through all specified modes of control and sequences of operation including full and part load conditions, and emergency conditions.

G. Verify that equipment operates in accordance with design intent and approved control diagrams. This shall include checking the operation of dampers, valves, smoke detectors, high and low limit controls, of a sample of 25% of components with a maximum failure limit of 10%.

H. Analog Input (AI) Sensors: (at a sample of 50% of the inputs on the sampled devices (see above for device samples) with a maximum failure rate of 10%). Spot-check AI sensors (space temperature sensors, outside, return, and mixed air temperature sensors, discharge air temperature sensors, chilled water and hot water temperature sensors, and humidity sensors, air and water differential pressure sensors, airflow monitoring stations, etc.) for acceptable accuracy (which is generally as specified for the device).

I. Analog Outputs - Valves, Dampers and Actuators: (at a sample of 50% of the inputs on the sampled devices (see above for device samples) with a maximum failure rate of 10%) Ensure that valves and dampers and their actuators close-off or seal against the maximum pressure differential. Ensure that the actuators stroke throughout the correct range (correlated with the programmed range) under operations pressures anticipated and that the positioners are set correctly where applicable.

J. Trends: Establish trends of control system points for a minimum of a two-week period prior to and throughout the Acceptance period. Trends shall be analyzed to identify any control problems, lack of capacity, control loops fighting or unstable, or other operational anomalies.

K. Automatic Switches: Spot-check (at a sample of 50% of the inputs on the sampled devices (see above for device samples) with a maximum failure rate of 10%) the operation of all automatic switches (pressure switches, current switches, flow switches, and others) to ensure that they are adjusted to proper make and break settings.

L. Verify the standalone functionality of the controllers. Typically this will involve disconnecting LAN communication wiring and ensure that the controller functions properly and that the loss of communication is acknowledged by the interface. Restore communications and ensure an orderly restoration to normal control.

M. Verify that the BAS interface, BAS software, graphics and functions are in accordance with design intent and approved control diagrams.

N. Check dial-in communications and internet access where applicable to ensure functionality.

3.16 SWITCHGEAR

A. Participants shall include CA and EC.

B. Sample: 100%.

C. FPT shall include ‘Common Elements for All Systems’ (above) to the extent applicable.

D. Review Start-Up Documentation.

E. As applicable, review the Independent Electrical Testing Agency report.

F. Refer to Building Power Outage Test.

3.17 DISTRIBUTION TRANSFORMERS DRY TYPE

A. Participants shall include: CA and EC.

B. Sample: 20%; Failure Limit 10%.

C. FPT shall include ‘Common Elements for All Systems’ (above) to the extent applicable.

D. Review Start-Up Documentation.

E. Review the Independent Electrical Testing Agency report (as applicable).

F. Review thermographic images (as applicable).

G. Measure current, voltage and harmonics under peak load conditions.

3.18 DISTRIBUTION PANELBOARDS AND ASSOCIATED LOADS

A. Participants shall include: CA and EC.

B. Sample: 20%; Failure Limit 10%.

C. FPT shall include ‘Common Elements for All Systems’ (above) to the extent applicable.

D. Review Start-Up Documentation.

E. Review the Independent Electrical Testing Agency report (as applicable).

F. Spot-check phase balance. Ensure proper, thorough, and accurate identification of load. Trip breakers and validate load identified. Test GFI breakers.

G. Circuit Labeling Test – Connected Equipment (excluding Lighting): Check labeling of circuits with connected equipment by opening circuit breaker and inspecting equipment shutdown or by

measuring loss of power at the equipment. Check labeling for consistency with existing facilities and/or record drawings.

H. Circuit Labeling Test – Receptacles and Lighting: Panelboard circuit labeling and grounding continuity shall be verified (up to 10% of circuits in each panel). Check circuit labeling by de-energizing circuits while circuit tester is in the receptacle.

I. Receptacle Polarity Test: Spot-check receptacles installed or reconnected under this contract with a receptacle circuit tester. Tester shall test for open ground, reverse polarity, open hot, open neutral, hot and ground reversed, hot or neutral and hot open.

J. As applicable, review the Independent Electrical Testing Agency report.

3.19 GROUND-FAULT RECEPTACLE CIRCUIT INTERRUPTER TESTS

A. Participants shall include: CA and EC.

B. Sample: 100%.

C. FPT shall include ‘Common Elements for All Systems’ (above) to the extent applicable.

D. Test each receptacle or branch circuit breaker having ground-fault circuit protection to assure that the ground-fault circuit interrupter will not operate when subjected to a ground-fault current of less than 4 mA and will operate when subjected to a ground-fault current exceeding 6 mA. Perform testing using an instrument specifically designed and manufactured for testing ground-fault circuit interrupters. ‘TEST’ button operation shall not be acceptable as a substitute for this test. Replace receptacles that do not shutoff power with 5/1000 of an ampere within 1/40th of a second and retest. Submit test report signed by the Test Engineer who performed this test.

3.20 UNINTERRUPTIBLE POWER SYSEM (UPS)

A. Participants shall include: CA, EC, and Factory Authorized Representative. All Parties shall be present during the entire test.

B. FPT shall include ‘Common Elements for All Systems’ (above) to the extent applicable.

C. Refer to Division 26. Functional testing will be performed in concert with the Factory Representative functional performance testing.

3.21 LIGHTING AND LIGHTING CONTROL SYSTEM

A. Participants shall include: CA and EC.

B. Sample: 20%, Failure Limit 10%.

C. FPT shall include ‘Common Elements for All Systems’ (above) to the extent applicable.

D. Witness specified Factory-Certified Start-Up Tests and demonstrations.

E. Spot-check the lighting systems Start-Up Documentation and ensure that all luminaires and lamps are operational, and fixtures are clean.

F. Spot-check occupancy sensor placement and test reliability of activation/deactivation.

G. Test photocells for functionality and accuracy.

H. Spot-check switches to ensure proper operation and circuiting.

I. Spot-check lighting schedules to ensure they are programmed per the Design Engineer's direction.

J. Spot-check lighting levels to ensure compliance with IES and/or the design requirements for the respective occupancy.

K. Test operation of circuits by changing system Date and Time to cause various circuits to switch modes. For rooms with occupancy sensors, validate the circuit energizes with occupancy in the space after the lights have been swept off. Test warning flicker prior to off sweep. Test cleaning and shed features.

L. Test operation of daylight dimming control system if applicable.

M. For exterior fixtures, simulate 'Night Mode' to validate function. Measure and record light level to ensure they meet the requirements and are generally provide adequate security. Check for excessive light level fluctuations or dark spots.

SECTION 019115 - BUILDING EXTERIOR ENCLOSURE COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general requirements and procedures for building exterior enclosure commissioning, including exterior opaque wall systems, exterior glazed wall systems, party walls, waterproofing systems, air and moisture barrier systems, and roofing construction that protect climate-controlled interior spaces from unconditioned spaces and the exterior environment, as follows:

B. Related Requirements:
1. Section "General Commissioning Requirements" for general requirements for commissioning including definitions, commissioning team membership, Government's responsibilities, Contractor's responsibilities, and commissioning authorities' responsibilities.
2. Divisions 03, 04, 07, and 08 Sections for building exterior enclosure commissioning requirements specific to the Work of each Section.

C. The purpose of the building exterior enclosure commissioning is to provide a process for independent, third-party verification that the installed performance of the building exterior enclosure meets or exceeds the minimum performance requirements set forth by the Contract Documents.
1. The commissioning plan includes by reference all requirements set forth by the Architect for preconstruction laboratory and field performance testing of the materials, components, systems, and assemblies that comprise the building exterior enclosure.
a. Full and complete compliance with the building exterior enclosure performance requirements for this project is required to achieve successful commissioning of the building exterior enclosure.

1.2 COMMISSIONING AUTHORITY'S RESPONSIBILITIES

A. In addition to the responsibilities listed in Division 01 Section "General Commissioning Requirements" the commissioning agent will provide the following as they relate to the building exterior enclosure.
1. Project-specific pre-functional checklists and commissioning process test procedures.
2. Verify the execution of commissioning process activities. Verification will include, but is not limited to review of product submittals; prepare construction checklists; review operating and maintenance data and test reports to verify compliance with the Contract Documents. Failure to meet the requirements of the Contract Documents will be reported by CxA in the "Issues Log."
3. Prepare and maintain issues log.
4. Witness systems and assemblies installation.
5. Compile test data, inspection reports, and certificates and include them in the closeout documents.

B. The commissioning services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1.3 CONTRACTOR'S RESPONSIBILITIES

A. In addition to the responsibilities listed in Division 01 Section "General Commissioning Requirements" provide the following as they relate to the building exterior enclosure.
1. Participate in design- and construction-phase coordination meetings.
2. Provide information to the CxA for developing construction-phase commissioning plan.

3. Provide schedule of field quality control tests and inspections required by the Contract Documents to CxA for incorporation into the commissioning plan.
4. Submit field quality control testing and inspection reports on exterior enclosure construction to the CxA.
5. Submit operation and maintenance data for systems, subsystems, and components to the CxA.
6. Participate in testing-procedures meetings.
7. Participate in testing of installed systems, subsystems, and construction.
8. Provide test data, inspection reports, and certificates to CxA.
9. Participate in maintenance orientation and inspection.
10. Participate in operation and maintenance training sessions.
11. Participate in final review at acceptance meeting.
12. Provide input for final commissioning documentation.

B. Cooperate with the commissioning authority personnel, including building exterior enclosure commissioning consultant, provide access to the Work, and provide adequate schedule for the commissioning tasks related to the Work.

C. Furnish copies of all shop drawings, manufacturer's product data, installation instructions, maintenance information, schedules, warranties, and other information requested for the building exterior enclosure systems and components.

D. Provide qualified personnel for assistance to complete the commissioning tests, including required air and water leakage testing for elements of the building exterior enclosure systems.

E. Submit a copy of the Contractor's project specific quality assurance program to be implemented for construction for review by Architect, Government, and CxA prior to start of construction.

F. Construct field mockups to facilitate field quality control testing and inspections as specified in individual Sections of the specifications in Divisions 03 through 08.
   1. Check for constructability of the building exterior enclosure, including but not limited to wall-to-window interfaces, roof-to-wall intersections, and provide personnel and representatives from each trade associated with installing the system.
   2. Ensure that personnel from each trade that will be completing the work in the field are utilized to construct each required mockup.
   3. Provide a written protocol and timeline for repair of deficiencies noted during the performance testing, or a written report from the third party agency performing the tests indicating what repairs were required for a successful test.
      a. Repaired elements shall not be covered up without review by the CxA. Photographic documentation may substitute for CxA field visit when applicable.

G. Quality Control Pre-Construction Conference: Schedule and conduct a quality control pre-construction conference to review the detailed quality control and construction requirements for all materials and/or systems as appropriate, not less than 15 working days prior to commencement of the applicable portion of the work related to the building exterior enclosure, and prior to constructing mockups.
   1. Attendees at this conference include all contractors that will be involved in the construction of the building exterior enclosure, including but not limited to, Contractor's superintendent, material suppliers and representatives, and testing agency.
   2. This conference will be to discuss construction sequencing and coordination of various trades, and to review the Contractor's quality assurance program for the building exterior enclosure.

H. Conduct weekly building exterior enclosure quality assurance meetings with the appropriate contractors in attendance to review and discuss issues and concerns related to the building exterior enclosure noted by the Architect, CxA or Government during the previous week.
   1. Maintain a nonconformance log indicating what action will be taken to correct the deficiencies and date corrections were completed.

I. Field Testing: Provide a representative to be present from each trade or contractor associated with installing the system during the random field testing of the building exterior enclosure for air and water leakage, as indicated in the individual Sections of Divisions 03 through 08.
   1. Provide a written protocol and timeline for repair of deficiencies noted during the performance testing, or a written report from the third party agency performing the tests indicating what repairs were required for a successful test.
   2. Provide a repair and remediation protocol for any system failures identified by the CxA, including a timeline for repair of all affected elements.

      a. Repaired elements shall not be covered up without review by the CxA. Photographic documentation may substitute for CxA field visit when applicable.

J. Provide copies of all test and inspection reports for inclusion in the Systems Manual to be submitted as part of the closeout documentation.

K. Provide Closeout Documents for inclusion in the Systems Manual for each major building exterior enclosure system, including the following:
   1. Exterior walls, including brick veneer and aluminum glazing systems.
   2. Asphalt Shingle roofing, roofing underlayment and sheet metal flashing and trim.
   3. Skylight systems
   4. Sealants, control joints, and expansion joints.

L. Provide labor and facilities to provide access to the work to be tested.

1.4 COMMISSIONING DOCUMENTATION

A. Commissioning Plan: Coordinate with and provide information to Commissioning Authority to permit updating of Commissioning Plan information with approval of final selections for materials, assemblies, and systems for the building exterior enclosure. Provide the following:

   1. Submittals, information for systems manuals, and other required documents and reports.
   2. Identification of installed exterior enclosure components, assemblies, systems, and equipment, including design changes that occurred during the construction phase.
   3. Certificate of completion, certifying that exterior enclosure assemblies are complete and ready for testing.
   4. Test and inspection reports and certificates.
   5. Corrective action documents.

B. Documents Log: Provide as part of the project record closeout documentation a dedicated CxA Log that includes the following related to the building enclosure commissioning:
   1. As-built drawings, including a copy of all details and drawings that were installed as part of any addendum or change order directives. All deviations from the contract documents shall be clearly marked or noted.
   2. Specifications for the project, including all accepted product substitutions and any additional specifications as part of any addenda or change order directives. Mark accepted product substitutions and deviations clearly.
   3. A copy of all accepted change orders.
   4. A copy of all final shop drawings for each product requiring shop drawings, with the A/E review comments, showing final as-built conditions.
   5. A copy of all warranties, organized by product, and any and all product manufacturer letters indicating the product as appropriate to use for the application intended on the project as well as any installation guidance.
   6. A master product list summarizing all products used on the project for construction of the building exterior enclosure, organized by tabs in a binder, including the following information:

a. Product name.
b. Product manufacturer.
c. Catalog or other applicable number for ordering.
d. Manufacturer’s contact information.
e. Product color.
f. Supplier contact information.
g. Product installation instructions.
h. Maintenance guide.
i. Manufacturer’s checklist for periodic review of the product and procedures for repairs.

1.5 COMMISSIONING SUBMITTALS

A. The following commissioning submittals are in addition to those specified in Division 01 Section "General Commissioning Requirements."
1. Submit commissioning submittals concurrently to commissioning authority. Submittal will be returned to Architect before being returned to Contractor.
2. Coordination Drawings: Provide cross references on all shop drawings indicating that drawings have been checked and cross-referenced by the Contractor to ensure adjacent elements, dimensions, and construction tolerances indicated allow all work at interfaces and intersections to be constructed.
3. Qualification Data: For fabricators, installers, and testing agencies.
4. Field Quality Control Reports: Test reports for air and water penetration and other specified building exterior enclosure tests completed.
5. Special inspection reports indicated in individual Sections.

1.6 QUALITY ASSURANCE

A. Quality Control Program: Furnish a detailed quality control program to demonstrate quality control procedures that will be followed during the installation of components of the building exterior enclosure, including, but not limited to, visual inspection, and where appropriate, field testing.

B. Preconstruction Commissioning Conference: Schedule a preconstruction commissioning conference for the building exterior enclosure before starting construction, at a time convenient to Government, commissioning authority, and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review commissioning responsibilities and personnel assignments. This Conference may be combined with the Quality Control Pre-construction Conference.
1. Attendees: Authorized representatives of Government, commissioning authority, Architect and consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
a. Commissioning plan.
b. Construction schedule.
c. Phasing.
d. Critical work sequencing and long-lead items.
e. Designation of key personnel and their duties.
f. Mockup construction and testing.
g. Procedures for testing and inspecting.
h. Submittal procedures.
i. Preparation of Record Documents.
3. Minutes: Record and distribute meeting minutes.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING VERIFICATION

A. Contractor shall perform the following:
   1. Certify that building exterior enclosure systems, subsystems, and construction have been completed according to the Contract Documents.
   2. Certify that field quality control procedures have been completed, field quality control reports have been submitted, discrepancies have been corrected, and corrective work approved.

B. Commissioning authority will witness and document field quality-control tests and inspections.
   1. Verify that field quality-control testing of building exterior enclosure has been completed and approved, that discrepancies have been corrected and corrective work re-inspected and retested.
   2. Promptly notify Architect and Contractor of irregularities and deficiencies in the work that are observed during performance of services.
   3. Annotate checklist or data sheet when a deficiency is observed.

C. Commissioning authority is not authorized to perform any of the following:
   1. Release, revoke, alter, or expand requirements of the Contract Documents.
   2. Approve or accept any portion of the work.
   3. Perform any duties of the Contractor.

D. Deferred Testing:
   1. If tests cannot be completed because of a deficiency outside the scope of the building exterior enclosure, the deficiency shall be documented and reported to the Government. Deficiencies shall be resolved and corrected by Contractor and tests rescheduled.

E. Testing Reports:
   1. Reports shall include measured data, data sheets, and a comprehensive summary describing the building exterior enclosure systems at the time of testing.
   2. Prepare a preliminary test report. Deficiencies will be evaluated by Architect to determine corrective action. Deficiencies shall be corrected and test repeated.

3.2 SYSTEMS TO BE COMMISSIONED

A. The systems requiring field testing and commissioning are specified in Divisions 03 through 08. The systems and elements to be commissioned include the following:
   1. Exterior Opaque Wall Systems:
      a. Brick Veneer

   2. Exterior Glazed Wall Systems:
      a. Aluminum Storefront Systems.
      b. Skylight Systems
   3. Asphalt Shingle roofing
   4. Thermal Insulation.
   5. Air and Moisture Barrier Systems.
   6. Exterior Joint Sealants.

3.3 PRE-FUNCTIONAL CHECKLISTS

A. Pre-functional checklists consist of procedures and checks to ensure systems and assemblies are ready for testing and/or inspection, and are provided by the CxA to the Contractor.
   1. The Contractor and appropriate subs provide their standard checklists to the CxA who will use them to develop the pre-functional checklists the contractors will complete prior to testing or inspection.

2. Subs shall complete pre-functional checklists as sections of work are completed and submit completed checklists to the CxA through the Contractor. Completion of the pre-functional checklist is notification that the specific system is complete and ready for testing or inspection.
3. The Contractor determines which trade is responsible for executing and documenting each of the line item tasks on the checklists and notes that trade on the checklist form.
4. The Contractor and subs, under their own direction, execute and document the pre-functional checklists were completed according to the approved drawings prior to acceptance testing or inspection.
5. The CxA performs periodic construction observations of selected systems.
6. The test procedures for the project have been coordinated with the testing requirements specified in each specification Section.
7. The CxA requires that the field quality control procedures be documented in writing, and does not witness the majority of pre-functional checklist procedures.
8. Items of non-compliance in material, installation, or setup are corrected at the Contractor's expense and the system or building enclosure assembly retested.
9. The Contractor shall correct all areas that are deficient or incomplete in the checklists in a timely manner.

B. Sample Checklists: Construction and Industry checklists shall be developed by the Contractor for the building exterior enclosure, including the following:
1. Waterproofing.
2. Brick Veneer.
3. Membrane air barriers.
4. Aluminum storefront systems.
5. Skylight systems
6. Exterior joint sealants.

C. General Checklist Commentary: The manufacturers' or contractors' checklists shall include a systematic series of events appropriate to the specific systems, including but not limited to the following:
1. Verify product specified is appropriate to the site conditions.
2. Verify installer is authorized by manufacturer to apply product.
3. Verify that weather conditions, substrates, and construction contiguous to assemblies are acceptable for application of product.
4. Verify that construction is within specified tolerances where systems will be installed.
5. Verify that stored materials are protected against moisture.
6. Verify that products are undamaged prior to installation.
7. Verify that products are correct size, shape, thickness, and color.
8. Verify that components are preassembled, including factory installed sealant, as indicated on the approved shop drawings.
9. Verify proper fasteners and adhesives are used.
10. Verify that isolation is provided between dissimilar metals.
11. Verify that proper safety measures are employed by installers.
12. Verify that materials are in accordance with approved submittals, including shop drawings, product data, and samples.
13. Verify that dimensions are correct.
14. Verify product installation is in accordance with manufacturer's written instructions.
15. Verify that erection tolerances are maintained regarding horizontal and vertical alignment and plumbness.
16. Verify anchorage to structure is secure for transfer of wind load.
17. Verify provisions for thermal expansion.
18. Verify provisions for deflection of structural members.
19. Verify that flashings, end dams, sub sills, and sealants are in place, including weep holes.
20. Verify that final cleaning is performed as required, and repairs are satisfactory. Verify that unsuitable repairs are replaced with new materials.
21. Verify that finished work is protected.

22. Verify that operating components of systems comply with accessibility requirements.
23. Verify that systems are ready for air leakage and water penetration test procedures.
24. Verify that warranties can be obtained.
25. Verify operation and maintenance data has been submitted.

3.4 TESTING PROCEDURES

A. The testing procedures are the step-by-step process which must be executed by the Contractor to fulfill the test requirements that are specified in the Contract Documents by the Architect in Divisions 03 – 08.

B. Objectives and Scope: Performance testing is to demonstrate that each system is operating or functioning according to documented Government objectives and Contract Documents.

C. Performance Test Procedures: Testing shall verify the performance of the assembly in its installed state under conditions specified in the testing requirements. Areas of deficient performance shall be identified and corrected.

D. Mockups of Exterior Wall Assemblies: Testing shall be done on mockup assemblies of the exterior building enclosure as described in the project specifications. These assemblies will be used to establish the installation practices and workmanship that will be maintained by the installers during the assembly of the exterior wall systems.
   1. Prerequisites: Pre-functional checklist items shall be complete and signed off by Contractor and sealants shall be cured prior to testing.
   2. AAMA certified independent testing agency shall conduct testing, document the test results, and the CxA will witness the testing.
   3. Cost for additional testing if work requires retesting will be borne by Contractor.
   4. Concerns identified during the testing of the mockups must be resolved before proceeding with installation of the permanent exterior wall and roof assemblies, including metal cladding, glazed curtain walls and storefronts, flashings, and joint sealants.

3.5 FIELD TEST PROCEDURES

A. General:
   1. Contractor and subcontractors for each building enclosure assembly shall review the test procedures for feasibility, safety, and warranty protection.
   2. Contractor and subcontractors shall provide assistance to the commissioning agent in preparing specific functional performance test procedures (answering questions about assemblies and sequences, etc.) as specified in individual specification Sections.
   3. Contractor shall arrange a startup orientation meeting before construction begins to reiterate to the subcontractors exactly what will be required of them, and to allow them to voice any concerns prior to the commencement of the work.
   4. Contractor shall review his quality control procedures, quality assurance inspection and testing procedures, review drawings and specifications, review shop drawings and submittals, review construction schedule and sequencing, material selection and compatibility, and other installation concerns.
   5. Contractor shall construct the field mockup(s) of the key details of the system in accordance with the construction documents. Mockups shall be constructed by the people representative of the skill level that will be working on the project.
   6. Contractor shall not install any components of the building enclosure, including mockup installation, until product submittals have been approved.
   7. Contractor shall certify materials comply with specified laboratory testing prior to installation of any building enclosure materials. Field testing assumes materials comply with laboratory tests.
   8. Contractor shall complete pre-functional checklists and certify that systems are ready for functional testing prior to any testing.
   9. Contractor shall address punch list items before functional testing.

10. Field testing shall be performed by an approved independent testing agency qualified to conduct the specified tests. The commissioning agent will not perform any tests, but will witness the tests.
11. In the event that a functional test fails, the Contractor shall determine the cause of the failure, and the appropriate and affected trades shall correct all deficiencies as soon as possible.
12. Contractor shall provide retesting for all failed tests. If more than two functional tests of the same system are required, the Contractor shall reimburse the Government and their subconsultants for all associated costs.
13. The commissioning agent may recommend solutions to problems found, however the burden of responsibility to solve, correct, and retest problems is the Contractor's responsibility.
14. Test performance requirements shall be as described in each individual Section where the testing requirements are specified.
15. The testing agency will record the results of the functional test on the test procedure form. Deficiencies or non-conformance issues shall be noted and reported to the Contractor.
16. Corrections of minor deficiencies identified may be made during the test at the discretion of the commissioning agent.
17. As tests progress and a deficiency is identified, the testing agency and commissioning agent will discuss the issue with the Contractor, document the deficiency and the Contractor's response and intentions for correction.
18. The testing agency notes each satisfactory demonstrated function on the test form. The Contractor, Architect, and Government's representative give final approval on each test using the same form, providing a signed copy to the commissioning agent.

B. Waterproofing:
   1. Complete construction checklist.

C. Air and Moisture Barriers:
   1. Complete construction checklist.
   2. Perform membrane thickness verification inspections (dry or wet film thickness) at a minimum of five locations on the mockup panel to comply with manufacturer's requirements. Dry film thickness measurements may be done by removing samples and measuring with a micrometer.
   3. Verify continuity of membrane at interconnections between materials, assemblies of materials, and penetrations.
   4. Verify structural integrity of the substrate.

D. Aluminum Storefront Systems:
   1. Install typical full size storefront assembly.
   2. Complete construction checklist.
   3. Test window unit for water penetration according to AAMA 501.2 "Spray Nozzle Water Testing" (at 10 percent and 50 percent completion for each system).

E. Asphalt Shingle Roof System:
   1. Complete construction checklist.
   2. Complete roof installation inspections.

F. Skylight Systems:
   1. Complete construction checklist.
   2. Complete installation inspections.
   3. Test skylight system and the perimeter intersection with the self-adhered flashing membrane according to AAMA 501.2 "Spray Nozzle Water Testing" (test each system).

G. Exterior Joint Sealants:
   1. Complete construction checklist of the joint sealant installation on the mockup panel.
   2. Allow joint sealants to fully cure prior to testing.
   3. Test joint sealant adhesion according to ASTM C 1521. (Joint sealants to be tested for each different substrate).

4. Repair tested sealants prior to further testing.

1.6 REFERENCE STANDARDS

A. ASTM C 1521 Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.

B. ASTM D 7234 Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.

C. AAMA 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.

Performance Testing Matrix
Building Envelope Commissioning

Property	*Standard Designation*	*Materials/Systems*	*Field Mockup*	*In-Situ*	*Frequency/Time Frame*
Water Penetration	AAMA 501.2	Aluminum Storefronts	N/A	2	10% and 50% completion
Water Penetration	AAMA 501.2	Skylight Systems	N/A	All	Once roofing underlayment is in place and prior to asphalt shingle installation
Sealant Adhesion	ASTM C1521	Exterior sealants	N/A	3	TBD

END OF SECTION 019115

02 41 00 - DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies demolition and removal of buildings, portion of buildings, utilities and other structures shown.

1.2 RELATED WORK

A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 00 EARTHWORK.

B. Safety requirements: GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.

C. Disconnecting utility services prior to demolition: GENERAL REQUIREMENTS.

D. Reserved items which are to remain the property of the Client: GENERAL REQUIREMENTS.

1.3 PROTECTION

A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of Section GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.

B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations.

C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

D. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.

E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum.

F. In addition, to previously listed fire and safety rules to be observed in performance of work, include following:

1. No wall or part of wall shall be permitted to fall outwardly from structures.

2. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
3. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.

1.4 UTILITY SERVICES

A. Demolish and remove outside utility service lines shown to be removed.
B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DEMOLITION

A. Completely demolish and remove buildings and structures, including all appurtenances related or connected thereto, as noted below:
   1. As required for installation of new utility service lines.
   2. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.
B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him, off the property. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square.
C. In removing buildings and structures of more than two stories, demolish work story by story starting at highest level and progressing down to third floor level. Demolition of first and second stories may proceed simultaneously.

3.2 CLEAN-UP

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Resident Engineer. Clean-up shall include off the property disposal of all items and materials not required to remain property of the Client as well as all debris and rubbish resulting from demolition operations.

END OF SECTION 02 41 00

SECTION 02 41 19 – SELECTIVE STRUCTURE DEMOLITION

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Demolition and removal of selected portions of the existing building or structure.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate detailed sequence of selective demolition and removal work, with starting and ending dates for each activity, interruption of utility services, and locations of temporary partitions and means of egress.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.4 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Standards: Comply with ANSI A10.6 and NFPA 241.

1.5 PROJECT CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: there are hazardous materials present and is indicated in a report per “Information Available to Bidders”.

1. If other materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

E. Storage or sale of removed items or materials **on-site** is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

PART 2 – PRODUCTS

Not used

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

D. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.

B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off indicated utilities with utility companies.

2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

3.3 PREPARATION

A. Temporary Facilities: Provide temporary partitions, barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

B. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.4 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

   a. Where façade and/or glazing is removed from building, provide waterproofing measures to prevent water intrusion into existing building until permanent construction is in place.

2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.

4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.

2. Pack or crate items after cleaning and repairing. Identify contents of containers.

3. Protect items from damage during transport and storage.

4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

B. Burning or burying of any material on site is prohibited.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 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 mandatory, as though the word "shall" have 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.

1.2 SUBMITTALS

A. Shop Drawings: Reproductions of contract drawings are unacceptable. Submit shop drawings to the Architect 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 for approval.

2. Shop Drawings for Reinforcing Steel Placement: The contract drawings 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 for approval to the Architect with reinforcing steel shop drawings.

B. Contractor Mix Design: Thirty (30) days minimum prior to concrete placement, submit for Architect approval a mix design for each strength and type of concrete. Proportioning of mix and submittal of mix design shall conform to ACI 318-95 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 Standard 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. Obtain approval 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
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

1.3 DELIVERY

A. Do not deliver concrete until vapor barrier, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement.

1.4 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.

PART 2 - PRODUCTS

2.1 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.

B.

Location	Strength	Max W/C Ratio	Air Entr.	Slump*
Footings	3000 psi	0.60	4-6%	4”
All other work	4000 psi	0.45	4-6%	4”

*Slump requirement is before the addition of high range water reducer or mid range water reducer admixture (HRWR or MRWR). Maximum slump after addition of HRWR or MRWR is 6 inches.

2.2 MATERIALS

C. Cement: ASTM C 150, Type I or II or ASTM C 595, Type IP 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 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 C 618, 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 C 989, Grade 120.

B. Water: Water shall be fresh, clean, and potable.

C. Aggregates: ASTM C 33, 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. Non shrink Grout: COE CRD-C-621.

E. Admixtures:

1. Air-Entraining: ASTM C 260.
2. Accelerating: ASTM C 494, Type C.
3. Retarding: ASTM C 494, Type B, D, or G.
4. Water Reducing: ASTM C 494, Type A, E, or F.
5. Performance Admixture by Barrier One or approved equal. (Reference Section 03 05 10 – Moisture Vapor Reducing Admixture)
    a. Moisture Vapor Reduction Admixture: ASTM D5084
    b. Shrink Reduction: ASTM C 157
    c. Corrosion Inhibitor: ASATM C1202; AASHTO T-259
    d. Certified Alkali Silica Reaction Inhibitor: ASTM C-1260
    e. Neither Accelerator nor Retarder: ASTM C494

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: ACI 301 unless otherwise specified.
2. Welded Wire Fabric: ASTM A 185 or ASTM A 497. Provide flat sheets only of welded wire fabric for slabs.
3. Wire: ASTM A 82 or ASTM A 496.
4 Dowels: Plain steel; ASTM A 675, Grade 80 or ASTM A 499.

H. Vapor Barrier: ASTM E1745-17, Class A:
1. Use full vapor retarder system in all areas under slabs, footings, and grade beams providing a complete moisture barrier between the subsurface ground and the concrete structure.
2. Use 15 mil high density polyethylene sheet.
3. Use greatest widths and lengths practical to eliminate joints whenever possible. Lap joints a minimum of 12 inches and seal with manufacturer’s seam tape per manufacturer’s recommendations. 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.

I. Materials for Curing Concrete:

1. Impervious Sheeting: ASTM C 171; waterproof paper, clear or white polyethylene sheeting, or polyethylene-coated burlap.

2. Pervious Sheeting: AASHTO M 182.

3. Liquid Membrane-Forming Compound: ASTM C 309, 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.

J. Expansion/Contraction Joint Filler: ASTM D 1751 or ASTM D 1752, 1/2-inch thick, unless otherwise indicated.

K. Joint Sealants:

1. Horizontal Surfaces (3 percent slope, maximum):

a. Outside Buildings: ASTM D 1190.
b. Inside Buildings: ASTM D 1190 or ASTM D 1850.

2. Vertical Surfaces (greater than 3 percent slope): ASTM C 920, Type M, Grade NS, Class 25, Use T.

L. Release Agent for Fiberglass Forms: Nox-Crete as manufactured by The Kinsman Corp., Omaha, Nebraska.

PART 3 - EXECUTION

3.1 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 inspection 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.

B. Removal of Forms: Prevent concrete damage during form removal. After placing concrete, forms shall remain in place for the following minimum time periods, not necessarily consecutive, where minimum temperatures specified in paragraph entitled "Curing Periods and Minimum Temperatures" are maintained adjacent to the concrete and formwork. 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.

Element	Time Period (Days Minimum)
Walls, column, pedestals, slabs, and beams	3

3.2 PLACING REINFORCEMENT & MISCELLANEOUS MATERIALS

A. ACI 301. 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.

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 and seal with manufacturer’s seam tape per manufacturer’s recommendations. 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. Tolerances: Place reinforcement and secure with galvanized or noncorrodible chairs, spacers, or metal hangers. Use concrete or other noncorrodible material for supporting reinforcement on the ground.

D. Splicing: AWS D1.4, 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 301 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. Expansion Joints and Contraction Joints: For slabs on grade provide as indicated. Make expansion joints 0.5-inch wide except as indicated otherwise. Fill expansion joints not exposed to weather with preformed joint filler material. Completely fill joints exposed to weather with joint filler material and joint sealant. Do not extend reinforcement or other embedded metal items bonded to the concrete through any expansion joint unless an expansion sleeve is used. Provide contraction joints, either

formed or cut with a jointing tool, to the indicated depth after the surface has been finished. Protect joints from intrusion of foreign matter.

I. Form Ties and Accessories: The use of wire alone is prohibited. Form ties and accessories shall not reduce the effective cover of the reinforcement.

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

3.3 MEASURING, MIXING, TRANSPORTING AND PLACING CONCRETE

A. ASTM C 94, ACI 301, ACI 302.1R, and ACI 304, except as modified herein. ASTM C 94. Provide mandatory batch ticket information for each load of ready-mix concrete.

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 C 94. 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.

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 directed.

E. Placing: Place concrete as soon as practicable after the forms and the reinforcement have been inspected and approved. 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. Position grade stakes on 10-foot centers maximum in each direction when pouring interior slabs and on 20-foot centers maximum for exterior slabs.

F. 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.

G. 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.

H. 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.

3.4 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 approval of corrective action prior to repair. The surface of the concrete shall not vary 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.

3.5 FLOOR, SLAB & MISCELLANEOUS CONSTRUCTION

A. ACI 302.1R, unless otherwise specified. Slope floors uniformly to drains where drains are provided. Depress the concrete base slab where ceramic tile is indicated. 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.

B. Finish: Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleed water appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleed water 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 bleed water.

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.

C. 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. Limit variation in cross section to 1/4-inch in 5 feet.

D. Pits and Trenches: Place bottoms and walls monolithically or provide waterstops and keys.

E. Curbs: Reinforce as indicated. Provide contraction joints spaced every 10 feet maximum unless otherwise indicated. 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.

3.6 CURING AND PROTECTION

A. ACI 301 unless otherwise specified. Begin curing immediately following form removal. 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 floor covering. 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.

Time Period (Days Minimum)	Concrete Structure or Cement Type
7	ASTM C 150, Type I or II, either with or without fly ash, pozzolan, or ground slag; and ASTM C 595 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).

3.7 SAMPLING AND TESTING

A. Sampling: ASTM C 172. Collect samples of fresh concrete to perform tests specified. ASTM C 31 for making test specimens.

B. Testing:

1. Slump Tests: ASTM C 143. 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 C 39. Make five 4” x 8” test cylinders for each set of tests in accordance with ASTM C 31. Test one cylinder at 7 days, three 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 50 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 C 42 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 C 173 or ASTM C 231. Test air-entrained concrete for air content at the same frequency as specified for slump tests.

END OF SECTION

SECTION 03 92 50 – REPAIR MORTARS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes trowel-grade repair mortar for horizontal patch and repair of existing substrate.

1. Noted on Drawings as “Traffic Coating”

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Manufacturer's Material Safety Data Sheets.

C. Qualification Data: For Installer

1.3 QUALITY ASSURANCE

A. Installation must be by a qualified, factory trained application using mixing equipment and tools approved by the manufacturer.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver products in original packaging, labeled with product identification, manufacturer, batch number and shelf life.

B. Store products in a dry area with temperature maintained between 50° and 85° F and protect from direct sunlight.

C. Handle products in accordance with manufacturer's printed recommendations.

1.5 PROJECT CONDITIONS

A. Do not install material below 50° F surface and air temperatures. These temperatures must also be maintained during and for 48 hours after the installation of products included in this Section.

B. Install quickly if substrate is warm and follow manufacturer’s warm weather instructions.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Ardex Engineered Cements

B. Equal as approved

2.2 MATERIALS

A. Repair Mortar:

1. Single-component, polymer-modified, cement-based repair mortar, containing Portland cement, graded specialty aggregates, dry acrylic polymer and integral corrosion inhibitors.

2. Acceptable Products:

a. "Ardex ERM"; Ardex Engineered Cements.

b. Equal as approved.

3. Performance and Physical Properties: Meet or exceed the following values for material cured at 73° F and 50 percent relative humidity:

a. Application: Trowel.

b. Working Time: 25 – 45 minutes.

c. Compressive Strength: 7,000 psi at 7 days, 8200 psi at 28 days, ASTM C109.

d. Flexural Strength: 1,200 psi at 7 days, 1,500 psi at 28 days, ASTM C78.

e. Modulus of Elasticity in Compression: 3.67 x 106 psi at 28 days, ASTM C469, modified.

f. Shrinkage: less than 0.06%at 7 days, less than 0.08%at 28 days, ASTM C157, air cured.

g. Rapid Chloride Permeability: 820 Coulombs, at 28 days, ASTM C1202.

h. Low -slump, non-sagging.

i. Color: Light Gray

j. Combustibility: Non-combustible, both before and after use.

B. Bonding and Anti-Corrosion Agent: "Ardex BACA"; Ardex Engineered Cements

C. Concrete Overlay:

1. Cement-based, polymer-modified concrete resurfacing material.

2. Acceptable Products:

a. "Ardex CD Fine (Concrete Dressing)"; Ardex Engineered Cements.

D. Concrete Sealer:

1. Sealer: Ardex CG (Concrete Guard):

a. High-performance, high solids, water-borne acrylic concrete sealer

E. Water: Water shall be clean, potable, and sufficiently cool (not warmer than 70°F).

2.3 MIXES

A. General: mixing ratios are based upon Ardex Engineered Cements. Follow manufacturer's written instructions and as specified herein.

1. Note: Other manufacturers, if approved, shall use their recommended mix designs.

PART 3 – EXECUTION

3.1 PREPARATION

A. General: Prepare substrate in accordance with manufacturer's instructions.

1. NOTE: installation instructions are per the basis of design manufacturer (Ardex).

2. Acid etching and the use of sweeping compounds and solvents are not acceptable.

B. Exposed Reinforcing Steel / Existing Railing Posts:

1. Mechanically remove all rust, corrosion and any contaminant that may act as a bond breaker using sandblasting or mechanical wire brushing to produce a white metal finish.

C. Concrete:

1. Mechanically remove all loose or weak concrete, dirt, debris and any contaminants that could act as a bond breaker. Over watered, frozen or otherwise weak concrete surfaces also must be cleaned down to sound, solid concrete. Use mechanical methods such as scarifying, needle scaling or similar. Do not use chemicals to prepare the substrate, including acid etching, solvents and adhesive removers.

2. Where mechanical removal is more aggressive than grinding (e.g. scarifying, rotomilling, scabbling, demolition hammer, etc.), the concrete must receive a light shot blast to remove any surface micro-cracking that may have been introduced by these more aggressive removal methods. This is in accordance with International Concrete Repair Institute (ICRI) recommendations (detailed in ICRI 310.2R-2013).

3. Repair areas also must be prepared in accordance with ICRI 03732 to create an exposed aggregate surface with a minimum surface profile of approximately 1/16" (1.5 mm) / ICRI concrete surface profile of 5 (CSP #5). Any additional preparation needed to achieve this must likewise be mechanical.

4. Saw cut repair areas in basic rectangular shapes. Cuts should be made at approximately a 90° angle and should be slightly keyed. The saw cut should not overrun the area to be patched, nor should it be so deep as to cut the reinforcing steel. Chip out the concrete inside each cut to a minimum depth of 1/4" and until the area is squared or boxed in shape. Chipping tools should be used such that they will not damage the surrounding areas of the concrete.

5. Thoroughly vacuum to remove all loose material. The resulting concrete surface must be deemed clean, sound and solid prior to proceeding with the installation.

3.2 PRIMING

A. Exposed reinforcing steel

1. Brush on a 10 mil thick coat of Ardex “BACA” and allow it to dry for 30 - 45 minutes prior to applying a second 10 mil coat. Allow the Ardex “BACA” to dry to the touch prior to installing the repair mortar, which must be placed over the coating within 24 hours of application. If the mortar is not placed within 24 hours, apply an additional coat of Ardex “BACA” before proceeding.

B. Concrete

1. Dampen the concrete as necessary with water until the surface is thoroughly saturated. Do not leave any bare spots. Prior to installing Ardex BACA, brush or vacuum off puddles and excess primer. The goal is to saturate the pores of the concrete while leaving the surface free of water (SSD, Saturated Surface Dry).

2. Do not allow the concrete to dry prior to applying a single 20 mil application of Ardex “BACA” as directed in the technical data sheet.

3. Allow the Ardex “BACA” to dry to the touch prior to installing the repair mortar, which must be placed over the coating within 24 hours of application. If the mortar is not placed within 24 hours, apply an additional coat of Ardex “BACA” before proceeding.

3.3 REPAIR MORTAR INSTALLATION

A. Mix the Ardex “ERM” in accordance with the technical data sheet. Once mixed, work a scrub coat of the Ardex “ERM” into the substrate(s), applying enough pressure to ensure good mortar-to-substrate contact.

B. In accordance with the technical data sheet, apply the Ardex “ERM” lift while the scrub coat is still wet. If the scrub coat is allowed to dry, it must be mechanically removed and reapplied before applying the lift.

1. Ardex “ERM” can be installed at a minimum thickness of 1/4” up to maximum thicknesses of 2” neat and 8” when extended with aggregate. Alternatively, Ardex “ERM” can be installed in subsequent 2” neat lifts up to a maximum thickness of 8”.

2. Once the Ardex “ERM” is applied, consolidate to remove any air pockets. Trowel / float to the desired finish once the repair mortar takes an initial set.

C. Keep the surface of the installation damp for the first 48 hours of curing via light water fogging or curing blanket. Curing compounds are not recommended due to the subsequent installation of Ardex “CD FINE”.

D. Allow the Ardex “ERM” to cure 7 days prior to proceeding with the resurfacing installation.

3.4 APPLICATION – CONCRETE DRESSING

A. To avoid pinholes, dilute Ardex “CG” with water in a 1:1 ratio. Apply with a short nap pain roller.

B. Ardex “CD” shall be installed using traditional concrete repair techniques, to include the use of a steel trowel and/or broom to achieve the desired finish. Dressing may also be applied using a squeegee or hopper gun.

1. Use the least amount of material possible to obtain complete coverage over the concrete surface. For maximum coverage, use the flat trowel application technique and then broom-finish. Work in areas small enough so that you can reach the newly applied surface easily to apply the broom finish without walking on it. Broom finish as you go but certainly before the dressing takes a firm set (usually 10-15 minutes depending upon jobsite conditions). Maintaining a “wet edge” as you work will help to minimize natural color variations that can occur between sections.

2. On vertical surfaces such as walls or stair faces, trowel, brush or spray the dressing using a hopper gun directly onto the prepared area. Smooth or brush the material to the desired finish.

C. Sealing of the Ardex “CD” can proceed as soon as the surface of the dressing has hardened sufficiently to resist damage from the sealing installation.

3.5 APPLICATION – CONCRETE SEALER

A. Mixing: The contents of the sealer container must be thoroughly stirred just prior to use to ensure a uniform consistency. For best results, mix with a mechanical mixing paddle and low speed drill.

B. Installation:

1. Sealer should be applied in two thin coats, allowing 2-4 hours between coats, depending upon atmospheric conditions. (Back-rolling is recommended when spraying to prevent puddling.)

2. Do not apply if rain, fog, or extremely high humidity (over 85%) is expected within 6-8 hours or if freezing temperatures could occur within 24 hours of application. Do not apply on surfaces under 50°F or over 90°F.

3. Allow sealer to cure a minimum of 24 hours before normal traffic, and a minimum of 72 hours before heavy traffic.

C. Maintenance: In order to attain maximum life from the dressing, it is essential that the surface be properly sealed and protected.

END OF SECTION

SECTION 04 20 00 – UNIT MASONRY

PART 1 – GENERAL

1.1 SUMMARY

A. Extent of each type of masonry work is indicated on Drawings:

1. Concrete Masonry Units (CMU)

2. Face Brick

3. Mortar

4. Anchors, ties, reinforcing, masonry accessories, and concealed flashings.

5. Other items as specified herein or indicated on the Drawings.

1.2 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. Samples: Submit samples of exposed masonry, showing full extent of colors and variations anticipated, for each standard shape and special shape unit.

1.3 QUALITY ASSURANCE

A. All work shall comply with the 2018 International Building Code (IBC 2018) and ACI 530.

B. Pre-installation Meeting:

1. Prior to installation of any permanent work, a pre-installation meeting with the Architect and mason (brick, mortar, accessories) shall convene to review at a minimum the following:

a. Project Manual, Detail Drawings, Manufacturer’s Specifications and

warranty requirements

b. Job and surface readiness, material storage and protection.

c. Review materials, preparation, installation, tolerances, protection, and coordination with other work.

d. Note deviations, differences or discrepancies.

e. Site conditions, project specific details, and other adverse conditions

2. Minutes shall be taken at the conference by the Masonry Contractor and distributed to all parties present and posted on the Project Web Site. All outstanding issues shall be noted in writing designating the responsible party for follow-up action and the timetable for completion.

1.4 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.

1.5 PROJECT CONDITIONS

A. 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 at ground level from clay staining by maintaining a perimeter of straw or other surfacing, 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.

B. Clean Air Space: Prevent grout and mortar from occurring in, bridging, forming ledges, and/or filling air space between masonry and back up walls.

C. 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.

D. 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.

PART 2 – PRODUCTS

2.1 FACE BRICK MATERIALS

A. Face Brick General:

1. Obtain masonry units of each type from one manufacturer, of uniform texture and color.

2. Size: Standard Modular: 3 5/8 inches x 2 1/4 inches x 7 5/8 inches unless otherwise indicated.

3. Assurance: Comply with **ASTM C216, Grade MW, Type FBS. NO EXCEPTIONS.**

B. Face Brick Schedule:

1. Brick Type 1:

a. Size: Modular for 3/8” mortar joint, 3-5/8” x 2-1/4” x 7-5/8”

b. Acme Brick Artesian Series, Blend 241 – “Desert Patch” - item# 128813

2. Brick Type 2:

a. Size: Modular for 3/8” mortar joint, 3-5/8” x 2-1/4” x 7-5/8”

b. Acme Brick Artesian Series, Blend 242 – “Via Roma” - item# 128872

3. Brick Type 3:

a. Size: Modular for 3/8” mortar joint, 3-5/8” x 2-1/4” x 7-5/8”

b. Acme Brick Artesian Series, Blend 243 – “Presidio” - item# 128952

4. Mix Brick Type 1, Type 2, and Type 3 at yard:

    a. Randomly mix 11% Type 1, 41% Type 2, and 48% Type 3 together on pallets at brickyard prior to delivery. “Acme Bulldogs Artisan Blend”

5. Equal manufacturers include the following:

    a. St. Joe Brick, Color to be Bulldog Blend, Modular:

        (1) 38% Dark Dark Range
        (2) 52% Dark Range
        (3) 10% Tan Range

2.2 CONCRETE MASONRY UNITS

A. 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.

B. 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.

2.3 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.

2.4 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 **Type S** mortar for all CMU.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout 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. Type 1: Pre-mixed mortar color to match existing mortar.

b. Type 2: Pre-mixed mortar color to match cast stone color. Refer to Division 4 Section “Cast Stone Masonry”

2.5 ACCESSORIES

A. Provide accessories from one of the following manufacturers:

1. Hohmann & Barnard

2. 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).

C. 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 Seismiclip® Interlock System"

    b. Furnish with 3/16" adjustable pintles of lengths required for proper embedment in mortar joints, spaced 16" o.c.

D. 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", EaCo Chem NMD 80, 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.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Remove and replace masonry units which are designated to be replaced on the Drawings. Provide new units to match adjoining units and install in fresh mortar or grout pointed to eliminate evidence of replacement.

B. Pointing: re-point all areas indicated on Drawings. 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.

3.2 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 piers 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.

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. Tool exposed joints slightly **concave** when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.3 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, 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.

3.4 CLEANING

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. Do not start brick cleaning until all trades adjacent to area to be cleaned have signed off on preparation and protection of their surfaces.**

2. Apply with a standard water hose nozzle (jet nozzles not allowed). Apply using a circular application pattern and maintain an adequate and consistent distance. **PRESSURE WASHERS WILL NOT BE ALLOWED AS A MEANS OF APPLYING OR CLEANING.**

   a. **Do not hold the spray nozzle closer than 8” to the wall.**

C. Pre-Cleaning:

1. Prior to cleaning brickwork, all large mortar droppings should be removed within 24 hours of laying with stiff bristled nylon 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 as specified herein 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.

END OF SECTION

SECTION 04 72 00 – CAST STONE MASONRY

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes custom cast architectural cast stone units as indicated on the Drawings (exterior caps, etc.).

B. Related Sections include the following:

1. Division 4 Section “Unit Masonry”

2. Division 7 Section “Joint Sealants”

1.2 REFERENCES

A. ACI 318 - Building Code Requirements for Reinforced Concrete.

B. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

C. ASTM C 33 - Standard Specification for Concrete Aggregates.

D. ASTM C 150 - Standard Specification for Portland Cement.

E. ASTM C 270 - Standard Specification for Mortar for Unit Masonry.

F. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.

G. ASTM C 642 - Standard Test Method for Specific Gravity, Absorption, and Voids in Hardened Concrete.

H. ASTM C 979 - Standard Specification for Pigments for Integrally Colored Concrete.

I. ASTM C 1194 - Standard Test Method for Compressive Strength of Architectural Cast Stone.

J. ASTM C 1195 - Standard Test Method for Absorption of Architectural Cast Stone.

K. ASTM C 1364 - Standard Specification for Architectural Cast Stone.

L. ASTM D 2244 - Standard Test Method for Calculation of Color Differences From Instrumentally Measured Color Coordinates.

M. Cast Stone Institute Technical Manual.

1.3 DEFINITIONS

A. Cast Stone: Highly refined architectural concrete stone product manufactured to simulate fine grain texture of natural stone.

B. Vibrant Dry Tamp (VDT) Casting Method: Vibratory ramming of damp, zero-slump concrete against rigid formwork until it is densely compacted and ready for immediate removal from form.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data.

B. Shop Drawings: Submit manufacturer's shop drawings including profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, annotation of components, and their locations in project as indicated on the drawings.

C. Verification Samples: Submit pieces of actual Cast Stone components, 12 inches square, illustrating range of color and texture to be anticipated in components furnished for project.

D. Test Results: Submit manufacturer's test results of Cast Stone components made previously by manufacturer using materials from same sources proposed for use in project.

1.5 QUALITY ASSURANCE

A. Standards: Comply with requirements of Cast Stone Institute Technical Manual.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Deliver Cast Stone components secured to shipping pallets and protected from damage and discoloration.

2. Each edge of the pallet shall be protected by a pre- molded edge protector and covered with a clear plastic wrap.

3. Number each custom piece individually to match shop drawings and schedules.

4. Each unit shall be protected by a plastic protective layer.

B. Storage:

1. Store Cast Stone components and installation materials in accordance with manufacturer's instructions.

2. Cast Stone components shall be stored in single stacks on pallets on level ground and covered with nonstaining, waterproof covers.

3. Ventilate under covers to prevent condensation.

4. Prevent contact with dirt.

C. Handling: Protect Cast Stone components during handling and installation to prevent chipping, cracking, or other damage.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Custom Units:

1. Reading Rock (Custom Cast)

2. Continental Cast Stone

3. Midwest Cast Stone

4. Capital Cast Stone

5. Or Equal

2.2 CUSTOM CAST STONE UNITS

A. Cast Stone: ASTM C 1364

1. Casting Method: Vibrant Dry Tamp.

2. Compressive Strength, ASTM C 1194: 6,500 psi minimum at 28 days.

3. Absorption, ASTM C 642 or C 1195: 6 percent maximum at 28 days.

B. Materials:

1. Portland Cement: ASTM C 150, Type I, white or gray as required to match specified color.

2. Coarse Aggregate: ASTM C 33, except for gradation; granite, quartz, or limestone.

3. Fine Aggregate: ASTM C 33, except for gradation; natural or manufactured sands.

4. Pigments: ASTM C 979, inorganic iron oxides.

5. Admixtures:

   a. ASTM C 494.

   b. Integral water repellants and other chemicals for which no ASTM standard exists. Previously established as suitable for use in concrete by proven field performance or through laboratory testing.

6. Water: Potable.

7. Reinforcing Bars: ASTM A 615/A 615M, galvanized or epoxy coated.

C. Surface Texture:

1. Fine grained texture, similar to natural stone.

2. No bugholes, air voids, or other surface blemishes.

D. Color:

1. Color to be selected from manufacturer’s standard.

E. Color Variation:

1. Viewing Conditions: Compare in direct daylight at 10 feet, between components of similar age, subjected to comparable weathering conditions.

2. Maximum Variation, ASTM D 2244:

   a. Hue: 2 units.

   b. Lightness, Chroma, and Hue Combined: 6 units.

2.3 ACCESSORIES

A. Mortar: provide colored mortar (Type 2) as specified in Division 4 Section “Unit Masonry” to match cast stone.

B. Anchors: Non-corrosive type, sized for conditions. Type 304 stainless steel. Strap anchors or other type as recommended by cast stone manufacturer for each individual piece of stone. Indicate on shop drawings all locations.

C. Sealant: As specified in Division 7 Section “Joint Sealants”.

D. Cleaner:

1. Manufacturer's standard-strength, general-purpose cleaner designed for

removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces.

2. Expressly approved for intended use by Cast Stone manufacturer and expressly approved by cleaner manufacturer for use on Cast Stone and adjacent masonry materials.

3. No acid or acid-based solutions shall be used.

2.4 CUSTOM CAST STONE UNIT FABRICATION

A. NO FIELD CUT UNITS WILL BE ALLOWED.

B. Shapes: Unless otherwise indicated on drawings, provide:

1. Suitable wash on exterior sills, copings, projecting courses, and components with exposed top surfaces.

2. Drips on projecting components, wherever possible.

C. Reinforcement:

1. As required to withstand handling and structural stresses.

2. Comply with ACI 318.

3. Minimum of 0.25 percent of cross-sectional area of panels which exceed 12 inches in width.

4. Minimum Reinforcing Cover: Twice diameter of reinforcing bars.

D. Curing:

1. Cure Cast Stone components with a direct fired steam generator at a minimum temperature of 105 degrees F (41 degrees C) for a minimum of 6 hours, within 12 hours of fabrication.

2. Cure Cast Stone components in presence of carbon monoxide and carbon dioxide to promote carbonation at surface, to minimize efflorescence.

E. Finishing: Remove cement film from exposed surfaces before packaging for shipment.

F. Tolerances: Fabricate Cast Stone components within tolerances in accordance with Cast Stone Institute Technical Manual, unless otherwise specified.

1. Dimensions: Plus or minus 1/8 inch.

2. Maximum Bow, Camber, or Twist: Length/360.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine construction to receive Cast Stone components. Notify Architect if construction is not acceptable. Do not begin installation until unacceptable conditions have been corrected.

B. Examine Cast Stone components for fit and finish before installation. Do not install unacceptable components.

C. The facing shall be free from chips, cracks, crazes or any other imperfection that would detract from the overall appearance of the finished wall. Architect has final judgment on appearance.

3.2 INSTALLATION

A. General: Install Cast Stone components in conjunction with materials specified in Division 4 Section “Unit Masonry”.

B. NO FIELD CUT UNITS WILL BE ALLOWED.

C. Setting:

1. Drench Cast Stone components with clear, running water immediately before installation.

2. Do not use pry bars or other equipment in a manner that could damage Cast Stone components.

3. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

4. Set Cast Stone components in a full bed of mortar, unless otherwise indicated on the drawings.

5. Fill vertical joints with mortar.

6. Make joints 3/8 inch, unless otherwise indicated on the drawings.

7. Leave head joints in copings and similar components open for sealant.

8. Rake mortar joints 3/4 inch for pointing. Sponge face of each stone to remove excess mortar.

9. Tuck point joints to a slight concave profile.

10. Provide weepholes at 24 inches o.c.

D. Sealant Joints:

1. Comply with requirements of Division 7 Section “Joints Sealants”.

2. Prime ends of Cast Stone components, insert properly sized foam backing rod, and install sealant using sealant gun.

3. Provide sealant joints at following locations and as indicated on the drawings.

    a. Cast stone components with exposed tops.

    b. Joints at relieving angles.

    c. Control and expansion joints.

3.3 TOLERANCES

A. Installation Tolerances: Comply with requirements of Cast Stone Institute Technical Manual.

1. Variation from Plumb: Do not exceed 1/8 inch in 5 feet or 1/4 inch in 20 feet or more.

2. Variation from Level: Do not exceed 1/8 inch in 5 feet, 1/4 inch in 20 feet, or 3/8 inch maximum.

3. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch or 1/4 of nominal joint width, whichever is greater.

4. Variation in Plane Between Adjacent Surfaces: Do not exceed 1/8-inch difference between planes of adjacent components or adjacent surfaces indicated to be flush with components.

3.4 REPAIR

A. Surface Repair:

1. Repair chipping and other surface damage noticeable when viewed in direct daylight at 20 feet.

2. Repair with matching touchup material provided by manufacturer and in accordance with manufacturer's instructions.

3. Repair methods and results to be approved by Architect.

3.5 PROTECTION

A. Protect Cast Stone components from splashing and other damage.

3.6 CLEANING

A. In-Progress Cleaning:

1. Clean Cast Stone components as work progresses.

2. Remove mortar fins and smears before tooling joints.

B. Final Cleaning:

1. Clean exposed Cast Stone, after mortar is thoroughly set and cured.

2. Cleaner:

a. Wet surfaces with water before applying cleaner.

b. Apply cleaner to Cast Stone in accordance with manufacturer's instructions.

c. Remove cleaner promptly by rinsing thoroughly with clear water.

END OF SECTION

SECTION 05 12 00 – STRUCTURAL STEEL

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The work includes the fabrication, erection, and shop painting of structural steel. Provide in accordance with AISC "Manual of Steel Construction" except as specified herein. In the AISC "Manual of Steel Construction" referred to herein, the "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings," the "Code of Standard Practice for Steel Buildings and Bridges," and "Structural Joints Using ASTM A 325 or A 490 Bolts" shall be considered a part thereto.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 09 90 00 Painting

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval by the Architect prior to fabrication. Prepare in accordance with the AISC "Detailing for Steel Construction" and AISC "Engineering for Steel Construction." Shop drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS standard welding symbols.

B. Erection Plan: Submit for record purposes. Indicate the sequence of erection, temporary shoring and bracing, and a detailed sequence of welding, including each welding procedure required.

C. Certificates of Compliance:

1. Steel
2. Bolts, nuts, and washers
3. Shop painting materials
4. Welding electrodes and rods
5. Nonshrink grout
6. Galvanizing

D. Welder, Welding Operation, and Tacker Qualification: Prior to welding, submit certification for each stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests.

1.4 DELIVERY AND STORAGE

A. Handle, store, and protect materials in accordance with the manufacturer's recommendations. Replace damaged items with new items, or repair as approved by

the Architect.

1.5 REGULATORY REQUIREMENTS (SHOP PRIMER)

A. Comply with State and Local regulations regarding release to atmosphere of volatile organic (VOC) and proper disposal of excess and waste materials.

PART 2 - PRODUCTS

2.1 STEEL

A. Structural Steel: ASTM A 992 (Fy = 50 ksi) for all wide flange shapes. ASTM A 572 (Fy = 50 ksi) for all other shapes.

B. Structural Steel Tubing: ASTM A 500, Grade B.

C. Round Bars: ASTM A36 (Fy = 36)

2.2 BOLTS, NUTS, AND WASHERS

A. Provide the following unless indicated otherwise.

B. Structural Steel:

1. Bolts: ASTM A 325, Type 1 or 2.

2. Nuts: ASTM A 563, Grade A, heavy hex style.

3. Washers: ANSI B18.22.1, Type B.

C. Stainless Steel:

1. Bolts, Nuts, and Washers: ASTM A276, Type 316

2.3 SHOP PAINTING

A. Provide materials free from hazardous components, such as lead, mercury or asbestos filler, as determined by Federal and State regulations.

B. Pretreatment: Mil. Spec. DOD-P-15328 or Fed. Spec. TT-C-490, Type I, II, or IV.

C. Primer: Fed. Spec. TT-P-645.

D. Rust Preventative: SSPC PS 8.01, suitable for temporary protection.

2.4 GALVANIZING

A. ASTM A 123 or A 153, as applicable, unless specified otherwise.

B. Galvanizing Repair Paint: Mil. Spec. DOD-P-21035.

2.5 STRUCTURAL STEEL ACCESSORIES

A. Welding Electrodes and Rods: AWS D1.1.

B. Nonshrink Grout: COE CRD-C-621, with no ASTM C 827 shrinkage. Grout shall be nonmetallic.

PART 3 - EXECUTION

3.1 FABRICATION

A. Markings: Prior to erection, members shall be provided with a painted erection mark. In addition, connecting parts assembled in the shop for reaming holes in field connections shall be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded. Do not locate match markings in areas that will decrease member strength or cause stress concentrations.

B. Shop Painting: Shop paint structural steel, except as modified herein. Do not paint steel surfaces embedded in concrete, galvanized surfaces, bearing surfaces, or surfaces within 1/2 inch of the toe of the welds prior to welding (except surfaces on which metal decking or shear studs are to be welded). Prior to assembly, paint surfaces which will be concealed or inaccessible after assembly. Do not apply paint in foggy or rainy weather; when the ambient temperature is below 45 degrees F or over 95 degrees F; or when paint may be exposed to temperatures below 40 degrees F within 48 hours after application, unless approved otherwise.

1. Cleaning: SSPC SP 6, except as modified herein. SSPC SP 3 or SP 6 for steel surfaces exposed in spaces above ceilings, attic spaces, crawl spaces, furred spaces, and chases. In addition, maintain steel surfaces free from rust, dirt, oil, grease, and other contaminants through final assembly.

2. Priming: Immediately after cleaning, apply primer to a minimum dry film thickness of 2.0 mil. Repair damaged primed surfaces with an additional coat of primer.

C. Galvanizing: Provide as indicated or specified. Galvanize after fabrication where practicable.

1. Galvanizing Repair: ASTM A 780, using galvanizing repair paint for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces that repair paint has been applied to.

D. Bearing Surfaces and Friction Type Joints: In the shop, coat with a temporary rust preventive. Remove coating, as recommended by the coating manufacturer, immediately prior to field erection.

3.2 ERECTION

A. Calibration wrenches shall be calibrated every two working days on a minimum of three typical bolts of each diameter. Provide for drainage in structural steel.

B. Base Plates and Bearing Plates: After final positioning of steel members, provide full

bearing under plates using nonshrink grout. Place nonshrink grout in accordance with the manufacturer's instructions.

3.3 CONNECTIONS

A. Connections not detailed shall be designed in accordance with AISC "Manual of Steel Construction." Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Punch, subpunch and ream, or drill bolt holes.

3.4 WELDING

A. AWS D1.1. Provide AWS D1.1 qualified welders, welding operators, and tackers.

B. Removal of Temporary Welds, Run-Off Plates, and Backing Strips: Remove only from finished areas.

3.5 HIGH-STRENGTH STRUCTURAL JOINTS

A. AISC "Manual of Steel Construction" for designing, assembling, and testing.

3.6 TESTS AND INSPECTIONS

A. Perform field tests, and provide labor, equipment, and incidentals required for testing.

B. Welds:

1. Visual Inspection: AWS D1.1, Section 6. Provide independent laboratory AWS-certified welding inspectors for fabrication/erection inspection and testing and verification inspections. Welding inspectors shall visually inspect and mark welds, including fillet weld end returns. Provide written report to Architect.

2. Bolts: Provide independent laboratory personnel to check bolt tightness. Provide written report to Architect.

3.7 PAINTING

A. Paint steel that is not encased in concrete, plaster or sprayed fireproofing. Do not shop paint in areas to be field welded, contact surfaces of slip critical connections, or areas to receive special finishes.

B. Field paint as required steel that has been welded or that is unpainted after connections have been tightened.

END OF SECTION

SECTION 05 31 00 – STEEL ROOF AND FLOOR DECKING

PART 1 - GENERAL

1.1 SUBMITTALS

A. Samples: Submit one sample of the proposed deck units and each type of accessory.

B. Catalog Cut Sheets: Submit cut sheet showing engineering properties for each type of decking and accessory.

1.2 DELIVERY, STORAGE AND HANDLING: Deliver, store and handle steel deck in a manner to protect it from corrosion, deformation and other types of damage. Exercise care not to damage the material and overload the decking during the construction period. The maximum uniform distributed storage load shall not exceed the design live load. All damaged material shall be replaced by the contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Flat rolled carbon steel sheets of structural quality, thickness not less than indicated before coating, meeting the requirements of AISI "Specifications for the Design of Cold-Formed Steel Structural Members", except as modified herein.

B. Zinc-Coated Steel: Provide zinc-coated steel deck and accessories. Zinc-coated steel will not require shop painting.

C. Accessories: Provide accessories of the same material as the deck and not lighter than 20-gage, unless specified otherwise herein. Provide manufacturer's standard type accessories, as specified herein.

1. Adjusting Plates: Provide adjusting plates or segments of roof units in locations too narrow to accommodate full-size roof units. As far as practicable, provide plates of the same gage and configuration as the roof units. Factory cut plates of predetermined size.

2. End Closures: Provide end closures of minimum 20 gage to close open ends at parapets, end walls, eaves, and openings through the roof.

3. Cover Plates: Provide butt cover plates, underlapping sleeves; or 2 inches wide noncombustible, pressure sensitive tape at end joints between adjoining, non-lapping units.

4. Miscellaneous Accessories: Provide cant strips, fasteners, ridge and valley plates and other types of plates and closures as indicated or as necessary to complete the work. Provide all accessories required for a finished installation.

PART 3 - EXECUTION

3.1 INSPECTION OF SUPPORT STRUCTURE: Prior to starting installation of deck units and

accessories, inspect the support structure to verify that the structure will permit the indicated field installation of the steel roof deck system without modification.

3.2 INSTALLATION: Install steel deck units in accordance with approved shop drawings. Place units on structural supports, properly adjusted, leveled, and aligned at right angles to supports. Extend deck units over three or more supports unless absolutely impractical. Report inaccuracies in alignment or leveling to the Architect and make necessary corrections before deck units are anchored permanently in place. Locate end laps over supports only, with minimum lap of 2 inches. Do not use unanchored deck units as a work or storage platform. Permanently anchor all units placed by the end of each working day.

A. Anchorage Methods: Design fasteners for anchoring the decking to the structural supports and adjoining units to withstand diaphragm shears and uplift forces. Size and spacing of attachments shall conform to the requirements of the Steel Deck Institute Diaphragm Design Manual. Size, type and spacing of attachments shall be clearly shown on the shop drawings.

B. Accessories: Install cover plates, adjusting plates, finish strips, closures and closure sheets as necessary to complete the work. Install finish strips and closure sheets as to lap one support a minimum of 2 inches.

C. Openings: Reinforce and frame openings through roof as necessary for rigidity and load-carrying capacity. Holes or other openings required for the work of other trades shall be drilled or cut and adequately reinforced by the respective trade; such holes or other openings larger than 6 inches in diameter shall be approved by the deck manufacturer.

D. Inspection: Inspect the decking top surface for flatness after installation. The top flanges of each sheet must be flat with no concavity or convexity which exceeds 1/16-inch (1.58 mm). A straight edge placed across any three contact surfaces shall not leave a gap of more than 1/16-inch between the straight edge and any point of the contact surface, corrective measures or replacement shall be provided. Reinspect the decking after corrective measures or replacement has been performed.

END OF SECTION

SECTION 05 50 00 – METAL FABRICATIONS

PART 1 – GENERAL

1.1 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 tube gates and infill panels (galvanized)
2. Steel tube dumpster gates (galvanized)
3. Dumpster gate panels and hardware
4. Steel Bollards
5. Woven wire fabric
6. Miscellaneous steel

B. Related Sections include the following:

1. Division 5 Section “Structural Steel”
2. Division 7 Section “Steel Metal Flashing and Trim”
3. Division 9 Section “Painting and Coating”
4. Division 22 Sections for trench drains.

1.2 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.

1.3 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

2.1 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-P-21035 (Ships).

2.2 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.

2.3 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 Bollards:

1. Standard:

a. Fabricate metal bollards from Schedule 40 steel pipe in configuration indicated on Drawings.

b. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch thick steel plate welded to bottom of sleeve.

c. Prime bollards with zinc-rich primer and paint per Division 9 Section “Painting and Coating”.

C. Steel tube gates and infill panels:

1. Framework: provide tubes, plates, and other components as specified herein.

2. All structural framework components to be galvanized.

a. Paint in accordance with Division 9 Section “Painting and Coating”

D. Dumpster Gate Panels and Hardware:

1. Panels:

a. General: Provide factory-formed metal panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

b. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and a flat pan between major ribs.

(1) Basis-of-Design Product: Subject to compliance with requirements, provide Berridge Manufacturing Company; M-Panel or equal.

(2) Major-Rib Spacing: 6 inches o.c.

(3) Panel Coverage: 36 inches.

(4) Panel Height: 0.75 inches

c. Metallic-Coated Steel Sheet: Aluminum-zinc alloy-coated steel sheet complying with ASTM A 792, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755.

(1) Nominal Thickness: 0.024 inch

(2) Exterior Finish: minimum two-coat fluoropolymer

(3) Color: Color shall match MGCCC Campus Standard color Berridge "Charcoal Grey". Manufacturer's to provide custom color if necessary to obtain an exact match.

2. Hardware:

a. Gate hinges, latches, hasps, cane bolts, and other hardware shall be fabricated from 316 stainless steel.

b. Minimum 3 hinges each gate leaf.

E. Woven-Wire Mesh Infill Panels: Fabricate panels from woven-wire mesh crimped into 1-by-1/2-by-1/8-inch metal channel frames to match existing pattern.

F. 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.

G. 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.

2.4 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 and Coating”. 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 and Coating”.

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

3.1 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.

3.2 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. Dumpster gate panels and hardware:

1. Fabricate in design as indicated on Drawings to provide a complete working system including framework, panels, gates, hardware.

C. 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.

3.3 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 and Coating”

END OF SECTION

SECTION 05 73 13 – ORNAMENTAL RAILING

PART 1 – GENERAL

1.1 SUMMARY

A. Fabricate and install pre-engineered, component-based, ornamental railing system.

1. Include all components for a complete installation including but not limited to structure, handrails, glazing, brackets, fasteners, etc.

B. Related Sections include the following:

1. Division 8 Section “Glazing”

1.2 DESIGN REQUIREMENTS

A. Railing assembly shall withstand a minimum concentrated load of 200 pounds applied vertically downward or horizontally in any direction, but not simultaneously, at any point on the top rail.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Furnish references listing projects of similar size and scop

B. Regulatory Requirements

1. Components and installation are to be in accordance with state and local code authorities

2. Components and installation are to follow current ADA and ICC/ANSI A117.1 guidelines.

1.4 SUBMITTALS

A. Submit product data Including description of materials, components, fabrication, finishes.

B. Submit manufacturer’s shop drawings, including plans, elevations, sections, and details, indicating materials, components, sizes, dimensions, tolerances, hardware, fasteners, finishes, options, accessories, and installation. Show details of attaching railing system to supports.

C. Submit manufacturer's samples of standard materials, finishes, colors, and textures.

D. Test Reports: Submit test reports indicating compliance with ASTM E985.

E. Manufacturers Quality Assurance: Submit manufacturer's certification that materials comply with specified requirements and are suitable for the intended application. Submit certification that the manufacturer has not less than 5 years experience producing the product specified in this section. The manufacturer or an approved installer will do the installation of this product.

F. Maintenance Instructions: Submit manufacturer's maintenance and cleaning instructions.

G. Warranty: Submit manufacturer's standard warranty.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.

B. Storage on site:

1. Store material in a location and in a manner to avoid damage. Stacking shall be done in a way, which will prevent bending.

2. Store material in a clean, dry location away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin, or polyethylene sheeting in a manner that will permit circulation of air inside the covering.

3. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of material.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Livers Bronze Co.

B. Equal as approved

2.2 MATERIALS

A. Stainless Steel: Type 304

1. Finish: Ornamental Grade, AISI No. 4.

B. Steel:

1. Bars: meeting ASTM A 36.

2. Finish: Powder coating – color as selected by Architect.

C. Glazing: provide GL-1 (1/2 inch clear laminated) per Division 8 Section “Glazing”. Glass is grouted into aluminum base.

2.3 MANUFACTURED UNITS

A. Railing system shall be “Struct-U-Rail” as manufactured by Livers Bronze Co. or approved equal.

2.4 ACCESSORIES

A. Cap Railing: Standard cap railing for glass is a formed stainless steel channel.

B. Side Railings: Fabricate 1.5” diameter side rails from stainless steel

C. Glass support bases: Use standard extruded aluminum base for ½” glass – Model 810A. Aluminum base is mounted continuous and is anchored at 27” o.c. for steel and 9” o.c. for concrete.

D. Handrail brackets: Stainless steel – fabricators standard bracket.

E. Trim/Fittings: stainless steel.

F. Fasteners:

1. All mechanical fasteners used in the assembly of stainless steel railings shall be manufactured from stainless steel.

2. Cement: Hydraulic, ASTM C 595, factory prepared with accelerator.

2.5 FABRICATION

A. All metal fabrication to be performed by a single source fabricator.

PART 3 –EXECUTION

3.1 INSTALLATION

A. Install in accordance with shop drawings and manufacturer's instructions at locations indicated on the drawings.

B. Erect work square and level, horizontal or parallel to rake of steps or ramp, rigid, and free from distortion or defects detrimental to appearance or performance.

C. Expansion joints shall be provided as needed to allow for thermal expansion or contraction.

D. Defective work:

1. Remove stained or otherwise defective work and replace with material that meets specification requirements.

2. Repair damaged finish as directed by Architect

3. Replace defective or damaged components as directed by Architect.

3.2 CLEANING

A. As installation is completed, wash thoroughly using clean water and soap; rinse with clean water.

B. Do not use acid solution, steel wool or other harsh abrasives.

END OF SECTION

SECTION 05 73 70 – ALUMINUM TUBE RAILINGS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes aluminum tube railings.

1. Provide aluminum handrails, guardrails, and railing systems, including concealed connectors, fasteners, and required accessories required for a complete installation.

1.2 SUBMITTALS

A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:

1. Details of material and construction.

2. Storage and handling requirements and recommendations.

3. Recommended installation requirements to properly accommodate the proposal railing and accessories.

B. Shop Drawings: Submit shop drawings for fabrication and installation of ornamental metal work. Include plans, elevations and detail sections. Indicate materials, methods, finishes and types of joinery, fasteners, anchorages and accessory items. Provide setting diagrams and templates for anchorages, sleeves, and bolts installed by others.

C. Samples: Submit rail sample of same alloy and thickness of the work.

1. Selection Samples: Submit color charts representing manufacturer's full range of available colors.

1.3 QUALITY ASSURANCE

A. Design railings and other fabrications, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated when tested per ASTM E935:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.

b. Concentrated load of 200 lbf applied in any direction.

c. Uniform and concentrated loads need not be assumed to act concurrently.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver railing systems and related components in protective packaging.

1. Upon delivery open cartons and carefully inspect for damage.

2. Maintain material in original packaging until installation.

B. Store components to avoid damage from moisture, abrasion, and other construction activities.

1.5 WARRANTY

A. Manufacturer's 20 year finish warranty covering checking, crazing, peeling, chalking, fading, or adhesion.

B. 2 year warranty covering system installation and components.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Superior Aluminum Products, Inc. (Series 5A)

B. CraneVeyor Corp. (CV Pipe Rail)

C. Equal as approved

2.2 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Bars and Tubing: ASTM B 221, Alloy 6063-T5/T52.

C. Extruded Structural Round Tubing: ASTM B 429, Alloy 6063-T6.

D. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.

E. Plate and Sheet: ASTM B209, Alloy 6061-T6.

2.3 ACCESSORIES

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

C. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

D. Grout: Non-shrink Portland cement-based hydraulic grout mixed and applied in accordance with manufacturer's instructions; gypsum based material are not acceptable.

1. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.4 FABRICATION

A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. Form work true to line and level with accurate angles and surfaces.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove flux immediately.

4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

D. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

E. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

F. Form changes in direction by bending.

G. Bend members in jigs to produce uniform curvature without buckling or otherwise deforming exposed surfaces.

H. Close exposed ends of railing members with end fittings.

I. Brackets, Flanges, Fittings, and Anchors: Provide floor flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

2.5 FINISHES

A. Baked on Enamel Colors: Selected from full range of manufacturer's standard colors.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

B. Expansion Joints: Provide expansion joints for continuous spans in excess of 40 feet. Strictly adhere to manufacturer's instructions for locations of expansion joints and fastening of expansion sleeves.

C. Install bottom rails in unspliced lengths between posts.

D. Install posts of continuous sections from mounting base to top rail.

E. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

F. Sleeve posts to concrete walks with non-shrink grout.

3.2 FIELD QUALITY CONTROL

A. Erection Tolerances: Install railings plumb and level, securely fastened, with vertical members plumb.

1. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

2. Maximum variation from plumb: 1/4 inch.

3. Maximum misalignment from true position: 1/4 inch.

4. Maximum misalignment between adjacent separated members: 1/8 inch.

3.3 CLEANING

A. Remove dust or other foreign matter from component surfaces; clean finishes in accordance with manufacturer's instructions.

B. Clean units in accordance with the manufacturer's instructions.

3.4 PROTECTION

A. After installation, protect installed work until project completion.

B. Ensure that finishes and structure of installed systems are not damaged by subsequent construction activities.

C. If minor damage to finishes occurs, repair damage in accordance with manufacturer's recommendations; provide replacement components if repaired finishes are unacceptable to Architect.

END OF SECTION

SECTION 06 10 00 – ROUGH CARPENTRY

PART 1 – GENERAL

1.1 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

    a. Typical, treated, MDO.

2. Wood nailers and blocking

    a. Typical and treated.

3. Other rough carpentry indicated

B. *NOTE: This Section governs all blocking behind wall mounted items. Coordinate with other Sections to ensure blocking is provided at all of these locations.*

C. Related Sections include the following:

1. Division 6 Section “Interior Finish Carpentry”

2. Division 6 Section “Interior Architectural Woodwork”

1.2 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

1.3 SUBMITTALS

A. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:

1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.

1.4 QUALITY ASSURANCE

A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

B. Grade Stamps for Concealed Lumber: Each piece of lumber, applied by inspection agency and showing compliance with each specified requirement.

C. Construction Panels: Comply with NBS PS 1 where veneer plywood is specified; comply with APA PRP-108 where APA rated panels are specified; bearing APA trademark showing compliance with each specified requirement.

1.5 DELIVERY STORAGE, AND HANDLING

A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

B. Remove from the site any wood products that have been subjected to moisture or that do not comply with the specified moisture requirements.

1.6 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

2.1 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.

2. MDO Trim: Exterior Grade B-B, MDO plywood.

3. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E 84.

2.2 ACCESSORIES

A. Provide ALL fasteners and anchorages with a hot-dip zinc coating (ASTM A153).

B. Construction Adhesive: Multipurpose Construction Adhesive: maximum VOCs: 70 grams/liter

2.3 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. All interior sill plates and miscellaneous blocking and lumber shall be southern pine lumber, treated with waterborne preservatives in accordance with AWPA Standard U1, Commodity Specification A, to the requirements of Use Category 2 (UC2).

B. Retention levels shall be as follows for Use Category 2 and 3B:

1. Micronized Copper Azole (MCA – YellaWood®): 0.06

2. Micronized Copper Quaternary (MCQ): 0.15

3. Alkaline Copper Quaternary (ACQ): 0.25

4. Chromated Copper Arsenate (CCA) or other arsenic containing preservatives will not be accepted.

C. 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.

PART 3 – EXECUTION

3.1 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 sheathing.

3. Fastening:

    a. For wall sheathing use #6 x 2” self-tapping screws at 6 inches on-center on panel edges, at 12 inches on-center along intermediate supports, and 3/8" minimum from panel edge.

END OF SECTION

SECTION 06 20 23 – INTERIOR FINISH CARPENTRY

PART 1 – GENERAL

1.1 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”

1.2 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.

1.3 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.

1.4 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 unforseen circumstances, finish carpentry materials must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.5 PROJECT CONDITIONS

A. Conditioning: Installer shall advise Architect 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

2.1 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. Species: maple or birch

C. Interior Hardwood – Plywood for Transparent Finish:

1. Grade: Grade A faces.

2. Species: maple or birch

3. Cut: plain 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. Trim and Edges: 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).

2.2 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.

2.3 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 Premium Standards.

C. Standing and Running Trim:

1. Fabricate to AWI Premium 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.

2.4 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: Premium.

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 and Coating”.

PART 3 – EXECUTION

3.1 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.

3.2 INSTALLATION

A. Grade: Install paneling and solid wood components to comply with requirements of AWI Premium 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 filler, sand smooth, and matching final finish where transparent finish is indicated.

3.3 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.

3.4 CLEANING

A. Clean work on exposed and semi-exposed surfaces.

3.5 PROTECTION

A. Installer of Finish Carpentry shall advise Architect 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 40 23 – INTERIOR ARCHITECTURAL WOODWORK

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Plastic-laminate cabinets and shelving
2. Architectural cabinets and shelving
3. Quartz countertops and panels
4. Solid surface countertops (some with integral sink basins)
5. Woodwork accessories (brackets, hinges, pulls, etc.)

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”.

1.2 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 laminate, quartz, solid surfacing for each type, color, pattern, and surface finish.
2. Thermoset decorative panels, for each type, color, pattern, and surface finish.
3. Cabinet hardware including all pulls, hinges, door locks, counter support brackets, grommets, and stand-offs.

1.3 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.

1.4 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

2.1 MATERIALS

A. Wood Products:

1. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing **no urea formaldehyde**.

a. Moisture resistant MDF is required within 2'-0" of a sink.

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. Wilsonart International

b. Formica Corporation

c. Abet Laminati

d. Pionite

e. Or equal

C. Thermoset Decorative Panels (Melamine): medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

1. Provide at interior locations of cabinets and drawers **only**. All other surfaces to be plastic laminate whether called out on the drawings or not.

D. Quartz Surfacing:

1. Acceptable Products:

a. Cambria

b. Dupont - Zodiaq

c. Silestone by Cosentino USA

d. Diresco

e. Hanstone

f. Or equal

2. Composition: Quartz aggregate, resin, and color pigments formed into flat slabs,

3. Anti-microbial protection integral to sheet.

E. Aluminum Tape: provide adhesive backed bronze anodized finished aluminum tape in widths indicated on Drawings (located in reveals).

F. Solid Surfacing:

1. Acceptable Products:

a. Dupont - Corian

b. Wilsonart Solid Surfacing

c. Formica Solid Surfacing

d. Durasen

2. Product Description: Homogenous sheet material composed of acrylic resins, fire-retardant filler materials, and coloring agents.

a. Nominal sheet thickness: 0.50 inch (0.25 inch at aprons below sills only)
b. Surface burning characteristics in accordance with ASTM E 84:

1.) Flame spread less than 25
2.) Smoke developed less than 25.

2.2 ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural woodwork. Manufacturer listed is Basis of Design.

B. Hinges:

1. All locations: Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, self-closing, 160 degree.

C. Wire Pulls:

1. Public areas: “DP3/AM Series” Antimicrobial Tab Drawer Pull (J-Style)by Doug Mockett & Company, back mounted, full length of door.

2. All other areas: 5/16 inch diameter x 4 inch pull (Stanley 4484, or equal).

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. Single and Double Prong Wardrobe Hooks: BHMA A156.16

H. Keyboard Tray: equal to “8480 Series Legato Arm” and “6460A81 HDPE Keyboard and Mouse Tray” as manufactured by Knape & Vogt.

1. Provide 1 at reception desk area.

I. 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.

J. Counter Support Bracket:

1. Inside Wall Mount: “EH-1818FM, Concealed Countertop Support Bracket” by Rangine Corporation (RAKKS).

K. Shelf and Rod Bracket: solid steel with platinum powder coat finish to support shelves 10 to 14 inches deep, 500 lb capacity per pair.

L. Clothes Rods: 1-1/2-inch diameter, .083 inch, polished stainless steel rod, lengths as required. Provide stainless accessories as required for a complete installation.

M. Round Grommets: equal to “TG Flip Top Series, 2" hole”, by Doug Mockett & Company. Color to be selected by Architect.

1. Provide 1 per 24” of open countertop areas in final locations as directed by Architect.

N. 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.

O. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

2.3 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: Premium

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 Exposed Surfaces: High-pressure decorative laminate as follows:

   a. Horizontal Surfaces Other Than Tops: Grade HGS.
   b. Vertical Surfaces: Grade HGS.
   c. Edges: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.

3. Materials for Semiexposed Surfaces Other Than Drawer Bodies: Thermoset decorative panels (melamine).

4. Drawer Sides and Backs: Thermoset decorative panels (melamine).

5. Drawer Bottoms: Thermoset decorative panels (melamine).

6. Colors, Patterns, and Finishes: As selected by Architect from laminate manufacturer's full range.

C. Architectural Cabinets and Shelving, Paneling, Standing and Running Trim, Transparent and Opaque Finish:

1. As specified in Division 6 Section “Interior Finish Carpentry”.

D. Quartz Countertops, etc.:

1. General: Except as otherwise indicated, provide separate quartz countertops and other quartz components (installed on support system as indicated).

2. Colors: As indicated on Drawings, or if not indicated, as selected from manufacturer’s full line.

   a. Provide waterfall and mitered edges where indicated on Drawings.

3. Accessories: provide manufacturer’s approved joint sealer and other accessories for a complete installation.

E. Solid Surfacing:

1. General: Except as otherwise, provide separate solid surface sills and aprons and countertops (some with integral sink basins).

2. Solid surface colors: As selected by Architect from manufacturer’s full range.

3. Finish: High Gloss

4. Accessories:

   a. Adhesive: manufacturer's seam kit adhesive, color-matched to panels to be seamed.

   b. Caulk/Sealant: manufacturer's color-matched silicone sealant.

2.4 FINISHING

A. Finish woodwork per Division 6 Section "Interior Finish Carpentry".

PART 3 – EXECUTION

3.1 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.

   1. Touch-up shop finishes at field 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. Provide cutouts for electrical panels and grommet holes. Verify locations of cutouts from on-site dimensions. Prime paint cut edges on openings; provide grommet covers per Architect's selection for exposed surfaces.

I. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

3. All counter heights shall be maximum 34" above finish floor to comply with ADA requirements unless indicated otherwise on Drawings.

   a. *NOTE: If a sink is present in the countertop, the maximum measurement is to the highest surface of the sink rim, NOT the countertop.*

4. Countertops without base cabinets for support shall not violate ADA minimum knee clearances.

J. Repair damaged and defective woodwork to eliminate visual and functional defects; where repair is not possible, replace woodwork.

3.2 ADJUSTING

A. Test installed work for rigidity and ability to support loads.

B. Adjust moving or operating parts to function smoothly and correctly

3.3 CLEANING

A. Clean exposed and semi exposed surfaces, including debris in cabinets and drawers.

3.4 PROTECTION

A. Protect woodwork from damage and maintain design environmental conditions.

END OF SECTION

SECTION 07 21 00 – THERMAL INSULATION

PART 1 – GENERAL

1.1 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. Sound attenuation batts

1.2 SUBMITTALS

A. Product Data: Product literature, samples and installation instructions for specified insulation.

1.3 QUALITY ASSURANCE

A. Use insulation of thickness required to provide specified Resistance "R" value.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Insulation shall be protected in the transit by plastic covers and by truck tarps. When material is stored at the jobsite, a reasonably level, drained storage area shall be provided. The insulation shall rest on firm blocking and shall be covered with tarps.

B. 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

2.1 MANUFACTURERS

A. Fiberglass Batts:

1. Johns Manville (Basis of Design)
2. Knauf (EcoBatt)
3. CertainTeed (Sustainable Insulation)
4. Or equal

2.2 MATERIALS

A. Sound Attenuation Batts:

1. Sound Attenuation Batts, Johns Manville Formaldehyde-free Sound Control Fiber Glass Batts (or equal).

a. Provide in interior metal stud walls, above ceilings and in other locations indicated on the Drawings.

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:

(1) Walls: unless otherwise noted, provide same thickness as that of the wall.

(2) Ceilings: 3-1/2” minimum thickness

b. Width: unless otherwise noted provide same as framing spacing indicated.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Installer must examine substrate and conditions under which insulation work is to be performed and must notify Architect in writing of unsatisfactory conditions. Do not proceed with insulation work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

3.2 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. Sound Attenuation Batts:

1. Interior Walls:

a. Position to fit snugly between studs.

b. Install low expansion foam at all cracks around doors in lieu of batts.

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.

END OF SECTION

SECTION 07 31 00 – ASPHALT SHINGLES

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes:

1. Granule surfaced asphalt shingle roofing.

a. Asphalt Roofing Shingles

2. Leak Barrier and Roof Underlayment (Self Adhering Roof Membrane)

3. Other accessories for a complete installation

B. Related Sections include the following:

1. Division 6 Section “Rough Carpentry”

2. Division 7 Section “Sheet Metal Flashing and Trim”

1.2 REFERENCES

A. ASTM D 3018 - Standard Specification for Class A Shingles Surfaced with Mineral Granules.

B. ASTM D 3462 - Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.

C. ASTM D 3161 - Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method).

D. ASTM D 7158 - Standard Test Method for Wind-Resistance of Sealed Asphalt Shingles (Uplift Force/Uplift Resistance Method).

E. UL 790 - Tests for Fire Resistance of Roof Covering Materials.

F. UL 997 - Wind Resistance of Prepared Roof Covering Materials.

1.3 SUBMITTALS

A. Product Data: Provide manufacturer's printed product information indicating material characteristics, performance criteria, and product limitations.

B. Manufacturer's Installation (application) Instructions: Provide published instructions that indicate preparation required and installation procedures.

C. Samples: provide 1 sample of each shingle specified (sample boards are acceptable), and 1 sample of each accessory specified.

D. Certificate of Compliance: Provide Certificate of Compliance from an independent laboratory indicating that the asphalt fiber glass shingles made in normal production meet or exceed the requirements of the following:

1. UL 790 Class A Fire Resistance.

2. UL 997 Wind Resistance.

3. ASTM D 3462.

4. ASTM D 7158, Class F and H.

E. Shop Drawings: Indicate specially configured metal flashing, jointing methods and locations, fastening methods and locations, and installation details, as required by project conditions indicated.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide all primary roofing products by a single manufacturer to satisfy full warranty requirements, including but not limited to the following: shingles, underlayment, leak barrier (self-adhering), ridge cap shingles, and starter (strip) shingles.

B. Installer Qualifications: Installer must be approved for installation of all roofing products to be installed under this section.

C. Maintain one copy of manufacturer's application instructions on project site.

D. Preinstallation Meeting:

1. The meeting shall take place prior to the start of any roofing activities, including demolition.

2. The meeting shall be conducted by the contractor with a manufacturer’s representative attending (mandatory). Send out meeting notice to the Architect and other attendees no less than 5 days prior to meeting date.

3. Attendees: Meeting to be called for by manufacturer’s certified contractor. Meeting’s mandatory attendees shall include the certified contractor and the manufacturer’s representative. Non-mandatory attendees shall include the owner’s representative, architect or engineer’s representative, and the general contractor’s representative.

4. Topics: contractor and manufacturer’s representative shall review all pertinent requirements for the project, including but not limited to requirements for the specified warranty, and special project (detail) conditions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store all products in manufacturer's unopened, labeled packaging until they are ready for installation.

B. Store products in a covered, ventilated area, at temperature not more than 110 degrees F; do not store near steam pipes, radiators, or in direct sunlight.

C. Store bundles on a flat surface. Maximum stacking height shall not exceed manufacturer's recommendations. Store all rolls on end.

D. Store and dispose of solvent-based materials in accordance with all federal, state and local regulations.

1.6 PROJECT/SITE CONDITIONS

A. Proceed with work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations to satisfy the full warranty.

1.7 WARRANTY

A. The Contractor is to cover damages to the building resulting from failure to prevent penetration of water during construction.

B. Material Warranty Period:

1. Lifetime warranty against manufacturing defects (labor and materials).

2. 130 mph wind warranty.

3. Warranted against algae discoloration for 10 years

C. Applicator's (Installers) Warranty: At completion of project and prior to final acceptance, the roofing contractor shall furnish in writing and notarized, 5 copies of 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. This warranty to include all roofing components, including underlayment, metal flashing, and asphalt shingles.

2. Address warranty to Owner and deliver to Architect for review and transmittal.

3. 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 weathertight and watertight condition, all without cost to Owner. Such warranty should reflect this paragraph verbatim and provisions of warranty as required by Close-out Documents.

1.8 EXTRA MATERIALS

A. Provide 200 square feet of extra shingles of each color specified.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Provide “Timberline HDZ Shingles” as manufactured by GAF

1. Equal manufacturers: Tamko, Atlas, Certainteed.

2. Color: as selected by Architect

3. Granule surfaced, self-sealing asphalt shingle with a strong fiberglass reinforced core and StainGuard Algae protection.

4. Dimensions (approx.): 13.25 inches x 39.375 inches

5. Exposure: 5.625 inches

6. Applicable Standards and Protocols:

a. UL Listed to ANSI/UL 790 Class A
b. ASTM D 7158, Class H
c. ASTM D 3161, Class F
d. ASTM D 3018, Type 1
e. ASTM D 3462
f. Dade County Approved
g. Florida Building Code Approved
h. Texas Dept of Insurance Approved

2.2 ACCESSORIES

A. Hip/Ridge Shingles:

1. High profile self sealing hip and ridge cap shingle matching the color of selected roof shingle.

2. “Timbertex” premium ridge cap shingle, as manufactured by GAF.

B. Starter (Strip) Shingles:

1. Required to provide full wind warranty.

2. Self-sealing starter shingle designed for all roof shingles.

3. Basis-of-Design Product: Subject to compliance with requirements, provide “ProStart” starter strip shingle, as manufactured by GAF.

C. Leak Barrier and Roof Underlayment (Self Adhering Roof Membrane):

1. Self-adhering, self sealing, bituminous leak barrier surfaced with a smooth polyethylene film. Approved by UL, Dade County, ICC, State of Florida and Texas Department of Insurance.

2. “StormGuard” leak barrier, as manufactured by GAF.

D. Roofing Cement: Asphalt Plastic Roofing Cement meeting the requirements of ASTM D 4586, Type I or II.

E. Nails: Standard round wire type roofing nails, corrosion resistant; hot dipped zinc coated steel, minimum 3/8 inch head diameter; minimum 10 gage barbed, ring, or deformed shank; shank to be of sufficient length to penetrate through roof sheathing or 3/4 inch into solid wood or through plywood or OSB by at least 1/8 inch.

PART 3 – EXECUTION

3.1 PREPARATION

A. Verify that the deck is dry, sound, clean and smooth. It shall be free of any depressions, waves, and projections.

B. Do not begin installation of new roofing materials until the roof deck has been properly prepared. Start of new roofing work is acceptance of existing conditions.

3.2 INSTALLATION – GENERAL

A. Install using methods recommended by the manufacturer and as specified herein.

B. Refer to Division 7 Section “Flashing and Sheet Metal” for additional information on metal flashings.

3.3 INSTALLATION – UNDERLAYMENTS

A. General: All surfaces to receive asphalt shingles to have layer of Leak Barrier and Roof Underlayment (Self Adhering Roof Membrane).

B. Eaves:

1. Eaves: Install eaves edge metal flashing tight with fascia; lap joints a minimum of 2 inches and seal with plastic cement or high quality urethane sealant (approved by the Architect); nail at the top of the flange.

2. Rake Edges: Install metal edge flashing over leak barrier; set tight to rake boards; lap joints a minimum of 2 inches and seal with plastic cement; secure with nails.

C. Hips and Ridges: Install leak barrier along entire lengths.

D. Roof Deck (main field of roof):

1. Install one layer of self-adhering leak barrier over the entire roof area. Install sheets horizontally so water sheds and nail in place.

2. Prior to installation of main field, install leak barrier at eaves, rakes, dormers and other vulnerable leak areas and where indicated on Drawings.

3. Lay roof underlayment over deck and overlap 3” at side laps and 6” at end laps.

a. For side and end laps: fasten 6” o.c.

b. For middle of the roll: fasten 12” o.c.

E. Penetrations:

1. Vent pipes: Install a 24 inch square piece of leak barrier over roof deck underlayment; seal tightly to pipe.

2. Vertical walls: Install leak barrier extending at least 6 inches up the wall and 12 inches on to the roof surface. Lap the membrane over the roof deck underlayment.

3. Roof penetrations: Install leak barrier from under the built-in counterflashing and 12 inches on to the roof surface lapping over roof deck underlayment.

3.4 INSTALLATION – SHINGLES

A. General:

1. Minimize breakage of shingles by avoiding dropping bundles on edge, by separating shingles carefully (not by "breaking" over ridge or bundles), and by taking extra precautions in temperatures below 40 degrees F.

2. Handle carefully in hot weather to avoid scuffing the surfacing, or damaging the shingle edges.

3. Consult the application instructions for the specified shingle for details.

B. Placement of Shingles:

1. Along rakes & eaves, install starter strip to underlayment in a 4" width of asphalt plastic roof cement.

2. Start first course with shingles placed 3/8" (3/4” maximum) over eave and rake edges to provide drip edge.

C. Nailing of Shingles:

1. Secure shingles with 6 nails per shingle. Apply fasteners per schedule below. Fastener must NOT be exposed and must NOT cover the self sealing strip.

2. Nails must be driven flush with the shingle surface. Do not overdrive or under drive the nails.

3. Front to back: 5-1/4” to 5-3/4” from exposed edge of shingle

4. Side to Side:

a. Nails 1 and 6: 1/2" to 2” from each edge

b. Nails 2 and 5: 7” to 9” from each edge

c. Nails 3 and 4: 14” to 16” from each edge

3.5 INSTALLATION – ACCESSORIES

A. Install all shingle accessories per manufacturer’s written application instructions and as specified herein.

3.6 PROTECTION

A. Protect installed products from foot traffic until completion of the project.

B. Any roof areas that are not completed by the end of the workday are to be protected from moisture and contaminants.

END OF SECTION

SECTION 07 62 00 –SHEET METAL AND FLASHING TRIM

PART 1 – GENERAL

1.1 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. Drip Edges, Eave, and Rake Flashing

2. Gutters

3. Downspouts

4. Sill Flashings

5. Miscellaneous sheet metal accessories.

6. Coatings and sealants as required for this application

B. Related Sections include the following:

1. Division 7 Section “Asphalt Shingles”

1.2 DESIGN REQUIREMENTS

A. Thermal movement: 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.

1.3 SUBMITTALS

A. Product data including product specifications, standard details, performance data, and general recommendations.

B. Shop Drawings: indicate location of all fabricated sheet metal flashing & trim shapes on roof plans and exterior wall elevations included in the Work. Include detail of profile attachment, terminations, joints, corners, supports, anchorage points/ slot locations, cleats, hooks/ hems/ edge conditions, closures, and special details. Provide anticipated profile dimensions & bend angles for all critical sheet metal profiles. Indicate profiles that are “custom fabricated” and those that are “prefabricated” profiles.

1. Show all shop fabricated sheet metal fabrications including seam pattern/ alignment, seam configuration and dimensions.

2. Indicate metal type, thickness, and surface finish for all sheet metal profiles.

3. Show all accessory products to be provided including but not limited to: mechanical fasteners, VHB tape, clips, sealant, & sealant tape.

4. Details for joining and securing sheet metal components, including layout, number of fasteners, clip spacing, & soldered connections.

5. Detail of expansion provisions including sliding joints, use of clips/ prepunched slotted holes, anticipated direction(s) of movement, maximum allowable movement, and fixed-point location.

6. Details of coordinated trades: provide flashing details for integrating mechanical, electrical and plumbing conditions.

7. Show all concealed cleats (keepers) and clip material, size, & gauge.

8. Termination Details of connections to adjoining work.

C. Profile Samples: when further shop drawing clarification is required by Architect, provide 12" min. fabricated profile (full width).

1.4 QUALITY ASSURANCE

A. Industry Standard: Except as otherwise shown or specified, comply with applicable recommendations and details of SMACNA Architectural Sheet Metal Manual, 6th Edition. Conform to dimensions and profiles shown or as approved on shop drawing submittal.

B. Field Measurements: Prior to fabrication of sheet metal flashing & trim, compare architectural drawings, approved shop drawings, and actual field measurements of substrates to receive sheet metal flashing & trim. Make necessary minor adjustments to satisfy design intent and functional performance. Notify Architect of any major discrepancies to structure and substrate that deviate from the original intent of the Contract Drawings.

C. Pre-Installation Conference: convene an installation conference to include the Architect, roofing contractor, and Architectural Sheet Metal installer in order to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

1. Review methods and procedures for installation including, but not limited to: substrates, sub framing, penetrations and other preparatory work.

2. Review drawings, specifications, submittals and other contract documents.

3. Review construction schedule verifying availability of all materials, personnel and equipment needed to proceed and avoid delays.

4. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including cold temperatures.

1.5 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).

1.6 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.

1.7 WARRANTY

A. Refer to Division 7 Sections "Asphalt Shingles" and for specific information regarding roof (w/ metal rider) watertightness warranty required where sheet metal and flashing trim occurs in these areas.

1. Roofing manufacturer must accept the metal as part of their system warranty.

B. Sheet metal finish warranty: 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.

1. **Warranty period shall be twenty years.**

C. Fabrication Warranty: provide 2-year fabrication warranty against sharp bends that fracture the metal, tears, and equipment induced damage to the sheet or coil.

D. Installation Warranty: provide 3-year guaranty covering the proper material or product application preventing failure due to corrosion, damage due to inappropriate clip methods, corrosive separation material, or other installer induced failure.

PART 2 – PRODUCTS

2.1 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.

c. Color: Berridge “Charcoal Grey” (no substitutions – campus standard. Other manufacturers must custom match to this color)

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.

1. Exposed Coil-Coated Finishes:

a. Aluminum Framing locations: provide in finish to match aluminum storefront per Division 8 Section “Aluminum Framed Entrances and Storefronts”.

2.2 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: per Division 7 Section “Joint Sealants”. Provide 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.

2.3 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.

2.4 SHEET METAL FABRICATIONS

A. General:

1. Fabricate flashing & trim to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks, true to line and levels indicated, and with exposed edges folded back to form hems.

2. Lay out sheet metal flashing & trim work so cross seams, when required, are made in direction of flow with higher profile overlapping lower profile. Stagger cross seams when aesthetics are critical.

B. Drip Edges, Eave, Rake, and Ridge Flashing: Pre-finished galvanized steel: minimum 22 gauge thick.

C. Base Flashing: Pre-finished galvanized steel: 20 gauge thick.

D. Counterflashing and Flashing Receivers: Pre-finished galvanized steel: 22 gauge thick.

E. Hanging Gutters:

1. Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers and gutter accessories from same metal as gutters.

2. Fabricate from the following materials:

    a. Pre-finished galvanized steel: 22 gauge thick.

    b. Gutters shall have inside finish of factory applied polyester with a coating resistant to weathering.

F. Downspouts:

1. Fabricate to cross section indicated.

2. Fabricate from the following materials:

    a. Pre-finished galvanized steel: 22 gauge thick.

    b. Downspouts shall have inside finish of factory applied polyester with a coating resistant to weathering.

3. Type:

    a. Subsurface Drainage: provide straight ends where downspouts discharge into existing subsurface drainage.

G. Downspout Adapter:

1. Provide “Model SG” angled outlet downspout shoe as manufactured by Piedmont Pipe Construction, Inc.

2. Length: 30 inch minimum

3. Materials:

    a. Downspout Adapter Body: 3/16” Stainless Steel, ASTM A 240, Type 316. Size to be coordinated with corresponding downspouts as indicated on documents. Provide fastening brackets as recommended by manufacturer.

    b. Provide powder coat finish in color to match downspout.

4. Downspout Adapter Collar: Provide 1/8” thick Stainless Steel, ASTM A 240, Type 316, to accept rectangular downspouts sized per this Section.

5. Cleanout Cover:

    a. 1/8” thick stainless steel, ASTM A 240, Type 316.

    b. Neoprene gasket w/ stainless steel screws

6. Fasteners: Self-tapping concrete screws, pan head bolts, and other suitable fasteners designed to withstand design loads. Provide Type 316 stainless-steel fasteners for exterior use.

7. Provide precast concrete splashblocks at each outlet location.

H. VTR Caps: Provide 24 gauge “beauty caps” over plumbing penetrations.

I. Miscellaneous Flashing:

1. Pre-finished galvanized steel: 22 gauge thick.

PART 3 – EXECUTION

3.1 INSPECTION

A. Contractor shall inspect all surfaces, areas and other contingent construction in or to which his work is to be installed and insure himself that they are in proper condition to receive the work to be performed under this Section.

1. Verify that sheathing surfaces are sound, dry, properly secured and that provision has been made for flashings, anchorage, and all other interface items attaching to or penetrating through the Work of this Section has been completed.

2. The Contractor shall notify the Architect in writing, before any work is installed, of any condition requiring correction. Failure to make such a report shall be construed as acceptance of the existing conditions and the responsibility to provide an acceptable installation.

3.2 PREPARATION

A. Verify field dimensions before fabrication. Notify Architect of any discrepancies between field measurements and dimensions indicated in Construction Documents.

3.3 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.

3.4 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. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

C. 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.

1. Counterflashings shall be designed for independent installation from base flashing to allow for thermal movement.

D. Hanging Gutters: Join sections with riveted and soldered joints. Provide for thermal expansion (max 50’-0”). Attach gutters at eave or fascia to firmly anchored gutter brackets spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to gutter opening.

E. Downspouts: Fabricate rectangular downspouts with straight ends. Furnish with metal hangers, from same material as downspouts, and anchors.

F. Sill Flashings: Fabricate sill and similar flashings with hemmed edges in configuration indicated on Drawings.

3.5 CLEANING

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturers written installation instructions.

B. Clean exposed metal surfaces, removing substances which might cause corrosion of metal.

3.6 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 84 00 – FIRESTOPPING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes through-penetration fire-stop systems for the following types of fire-resistance-rated assemblies:

1. Penetrations in fire-resistance-rated walls.

2. Penetrations in horizontal assemblies (i.e. floors/celings).

3. Penetrations in smoke barriers.

B. Related Sections include the following:

1. Division 1 Section “Testing Laboratory Services”

2. Division 7 Section “Joint Sealants”

1.2 PERFORMANCE REQUIREMENTS

A. F-Ratings: Provide fire-stop systems with F-ratings equaling or exceeding fire-resistance rating of constructions penetrated as determined per ASTM E 814.

B. T-Ratings: Provide fire-stop systems with T-ratings required, as well as F-ratings, determined per ASTM E 814, where systems protect penetrating items with potential to contact adjacent materials in occupiable floor areas including, but not limited, to the following:

1. Penetrations located outside wall cavities.

2. Penetrations located outside fire-resistive shaft enclosures.

3. Penetrations located in construction containing fire-protection-rated openings.

4. Penetrating items larger than 4-inch-diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

C. For fire-stop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant fire-stop systems.

2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide fire-stop systems capable of

supporting floor loads involved either by installing floor plates or by other means.

3. For penetrations involving insulated piping, provide fire-stop systems not requiring removal of insulation.

D. For through-penetration fire-stop systems exposed to view, provide products with flame-spread indices of less than 25 and smoke-developed indices of less than 450, when tested per ASTM E 84.

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include details of installation and design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.

C. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire resistance rated assembly.

D. Qualification Data: For qualified Installer.

E. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is qualified by having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its through-penetration fire-stop system products to Contractor or to an installer engaged by Contractor does not in itself confer qualification on buyer.

B. Source Limitations: Obtain through-penetration fire-stop systems, for each kind of penetration and construction condition indicated, from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide through-penetration fire-stop systems that comply with the following requirements and those specified in "Performance Requirements" Article:

1. Fire-stopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing

testing and follow-up inspection services for fire-stop systems acceptable to authorities having jurisdiction.

2. Through-penetration fire-stop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:

   a. Through-penetration fire-stop system products bear classification marking of qualified testing and inspecting agency.

   b. Through-penetration fire-stop systems correspond to those indicated by reference to through-penetration fire-stop system designations listed in the UL in "Fire Resistance Directory."

D. Preinstallation Conference: Conduct conference at Project.

E. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate fire-stop systems.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration fire-stop systems when ambient or substrate temperatures are outside limits permitted by through-penetration fire-stop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration fire-stop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration fire-stop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire-stop systems.

C. Notify manufacturer's representative at least seven days in advance of through-penetration fire-stop system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up through-penetration fire-stop system installations that will become concealed behind other construction until manufacturer's representative and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hilti, Inc.
2. 3M Fire Protection Products
3. Tremco Incorporated
4. STI (Specified Technologies, Inc.)
5. Or equal

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Horizontal assemblies include floors, floor/ceiling assemblies.
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.

E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

2.3 MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 ACCESSORIES

A. Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials.

    a. Slag-/rock-wool-fiber insulation.
    b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
    c. Fire-rated form board.
    d. Fillers for sealants.

2. Temporary forming materials.

3. Substrate primers.

4. Collars.

5. Steel sleeves.

6. Provide escutcheons to cover penetrations that are exposed in finished, occupied areas unless otherwise included in the UL System design or specified as work of other sections. Escutcheons are not required for unexposed areas, such as chases, inside walls, and alike, unless part of the UL Classified assembly.

2.5 MIXING

A. For those products requiring mixing before application, comply with through-penetration fire-stop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration fire-stop systems to comply with written recommendations of fire-stop system manufacturer and the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration fire-stop systems.

2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration fire-stop systems. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration fire-stop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-stop system materials. Remove tape as soon as possible without disturbing fire-stop system's seal with substrates.

3.3 INSTALLATION

A. General: Install through-penetration fire-stop systems to comply with "Performance Requirements" Article and fire-stop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Clean openings immediately before installing fire-stop systems.

1. Remove foreign materials that could interfere with adhesion of fire-stop systems.

2. Remove laitance and form-release agents from concrete.

3. Produce clean, sound surfaces capable of developing optimum bond with fire-stop systems. Remove loose particles remaining from cleaning operation.

C. Install fill materials for fire-stop systems by proven techniques.

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

D. Accessories: Install accessories of types required to support fill materials during their application and in the position necessary to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials, remove combustible forming materials and other accessories that are not permanent components of fire-stop systems.

E. Identification: Identify fire-stop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each fire-stop system installation where labels will be visible. Include the following information on labels:

1. The words: "Warning--Through-Penetration Fire-stop System--Do Not Disturb. Notify Facilities Engineering of Any Damage."

2. Contractor's name, address, and phone number.

3. Through-penetration fire-stop system designation of applicable testing and inspecting agency.

4. Date of installation.

5. Fire-stop system manufacturer's name.

6. Installer's name.

F. Clean excess fill materials adjacent to openings as installation progresses by methods and with cleaning materials that are approved in writing by manufacturers and that do not damage materials in which openings occur.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

1. Notify Architect at least seven days in advance of fire-stop system installations; confirm dates and times on days preceding each series of installations.

B. Do not cover up fire-stop system installations that will become concealed behind other construction until inspecting agency and building inspector have examined each installation.

C. Inspecting agency will state in each report whether inspected fire-stop systems comply with or deviate from requirements.

D. Enclosing fire-stop systems with other construction only after inspection reports are issued. Where deficiencies are found, repair or replace fire-stop systems to comply with requirements.

3.5 SCHEDULE

A. Where UL-classified systems are indicated, they refer to the alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Fire-stop Systems with No Penetrating Items: Comply with the following:

1. UL-Classified Systems: C-AJ-0001-0999, F-A-0001-0999, W-J-0001-0999, or W-L-0001-0999.

2. Type of Fill Materials: Latex sealant or intumescent putty.

C. Fire-stop Systems for Metallic Pipes, Conduit, or Tubing: Comply with the following:

1. UL-Classified Systems: C-AJ-1001-1999, F-A-1001-1999, W-J-1001-1999, or W-L-1001-1999.

2. Type of Fill Materials: Latex sealant or intumescent putty.

D. Fire-stop Systems for Nonmetallic Pipe, Conduit, or Tubing: Comply with the following:

1. UL-Classified Systems: C-AJ-2001-2999, F-A-2001-2999, W-J-2001-2999, or W-2001-2999.

2. Type of Fill Materials: Latex sealant, intumescent putty, intumescent wrap strips, or fire-stop device.

E. Fire-stop Systems for Electrical Cables: Comply with the following:

1. UL-Classified Systems: C-AJ-3001-3999, F-A-3001-3999, W-J-3001-3999, or W-L-3001-3999.

2. Type of Fill Materials: Latex sealant, or intumescent putty.

F. Fire-stop Systems for Cable Trays: Comply with the following:

1. UL-Classified Systems: C-AJ-4001-4999, F-A-4001-4999, W-J-4001-4999, or W-L-4001-4999.

2. Type of Fill Materials: pillows/bags.

G. Fire-stop Systems for Insulated Pipes: Comply with the following:

1. UL-Classified Systems: C-AJ-5001-5999, F-A-5001-5999, W-J-5001-5999, or W-L-5001-5999.

2. Type of Fill Materials: Intumescent wrap strips.

H. Fire-stop Systems for Miscellaneous Electrical Penetrants: Comply with the following:

1. UL-Classified Systems: C-AJ-6001-6999, F-A-6001-6999, W-J-6001-6999, or W-L-6001-6999

2. Type of Fill Materials: Latex sealant, or intumescent putty.

I. Fire-stop Systems for Miscellaneous Mechanical Penetrations: Comply with the following:

1. UL-Classified Systems: C-AJ-7001-7999, F-A-7001-7999, W-J-7001-7999, or W-L-7001-7999.

2. Type of Fill Materials: Latex sealant.

J. Fire-stop Systems for Groupings of Penetrations: Comply with the following:

1. UL-Classified Systems: C-AJ-8001-8999, F-A-8001-8999, W-J-8001-8999, or W-L-8001-8999.

2. Type of Fill Materials: intumescent wrap strips, fire-stop device or intumescent composite sheet.

K. Fire-stop Systems for Top of Wall: Comply with the following:

1. UL-Classified Systems: H-WD-1000 series.

2. Type of Fill Materials: Latex elastomeric sealant, or latex elastomeric spray.

END OF SECTION

SECTION 07 92 00 – JOINT SEALANTS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes sealants as indicated on the drawings and for the following applications, including those specified by reference to this Section:

1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:

a. Control and expansion joints in cast-in-place concrete, except pavement, walkway and curbing that are covered in other specification sections.
b. Joints between different materials indicated.
c. Perimeter joints between materials and frames of doors and windows.
d. Control and expansion joints in ceiling and overhead surfaces.
e. Other locations indicated or required to properly seal buildings.

2. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

a. Perimeter joints of exterior openings where indicated.
b. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
c. Perimeter joints between interior wall surfaces and frames of interior/exterior doors, windows, and entrances.
d. Joints between plumbing fixtures and adjoining walls, floors, and counters.
e. Other joints as indicated.

3. Interior joints in the following horizontal traffic surfaces:

a. Control and expansion joints as indicated.

B. Field Adhesion Testing **is required prior to application** of any final sealant work.

C. Related Sections include the following:

1. Division 1 Section “Testing Laboratory Services”

2. Division 7 Section “Firestopping” for sealant for fire rated partitions

1.2 PERFORMANCE REQUIREMENTS

A. Provide joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.3 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.

   a. Include primer literature with the submittal document unless the manufacturer's sealant submittal specifically eliminates the need for a primer.

   b. 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.

2. Include Safety Data Sheets for sealants.

3. Preparation instructions and recommendations.

4. Standard drawings illustrating manufacturer's recommended sealant joint profiles and dimensions applicable to Project.

B. Color Samples: Submit manufacturer's standard color chart. Submit actual cured samples of each chosen color for verification of actual color to be installed. Multiple cured samples may be required for selection.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.

2. Joint-sealant manufacturer and product name.

3. Joint-sealant formulation.

4. Joint-sealant color.

D. Preconstruction compatibility and adhesion test reports.

E. Preconstruction field-adhesion test reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Experienced Installer equipped and trained for application of joint sealants required for this Project with record of successful completion of projects of similar scope.

B. Single Source Responsibility: Provide exterior joint sealants by a single manufacturer responsible for testing of Project substrates to verify compatibility

and adhesion of joint sealants.

C. Preconstruction Manufacturer Laboratory Compatibility, Staining, and Adhesion Testing: Submit four samples of each material that will be in contact with or affect joint sealants. Test sealants with substrate materials using either ASTM C 1087 or manufacturer's standard test methods to determine requirements for joint preparation, including cleaning and priming. Test sealants with related materials to verify compatibility.

D. Preconstruction Field-Adhesion Testing: Prior to installing joint sealants, field test adhesion to joint substrates using ASTM C 1193 Method A or method recommended by manufacturer. Verify adhesion is adequate. Modify joint preparation recommendations for failed joints and retest. Submit written report to Architect.

E. Mockups: Provide joint sealant application within mockups required in other Sections identical to specified joint sealants and installation methods.

1.5 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.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.

2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.

3. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Original statement on Installer's letterhead in which Installer agrees to repair or replace joint sealants that demonstrate deterioration or failure within warranty period specified.

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

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that demonstrate deterioration or failure under normal use within warranty period specified.

1. Warranty Period for exterior Silicone Sealants: 20 years date of Substantial Completion.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Dow Corning Corp

B. BASF Construction Chemicals

C. Tremco Sealants and Waterproofing

D. Pecora Corporation

E. Or equal.

2.2 MATERIALS

A. General:

1. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Colors of Exposed Joint Sealants: Manufacturer’s standard color that is the closest to the lightest adjacent substrate.

3. Continuous-Immersion-Test-Response Characteristics: Where elastomeric sealants will be immersed continuously in water, provide products that have undergone testing according to ASTM C 1247, including initial six-week immersion period and additional immersion periods specified below, and have not failed in adhesion or cohesion when tested with substrates indicated for Project.

a. Three additional four-week immersion periods.

4. Do not block weep holes or interfere with concealed drainage path when using sealant.

B. Exterior General Use: single-component, nonsag, neutral-curing silicone joint sealant, non-staining, with Class 100/50.

1. Provide equal to Dow Corning 790 Silicone Building Sealant.

C. Exterior Concealed Joints and Under Thresholds: One-part butyl rubber caulk conforming to FS TT-S-001657, Type I

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: Two-part polyurethane conforming to ASTM C920, Class 25, Type M; self-leveling.

F. Interior Non-wet Areas: One-component acrylic latex water-based sealant conforming to ASTM C834.

G. Interior Wet Areas: One-part, mildew-resistant silicone rubber conforming to ASTM C920, Type S, Class 25, Grade NS.

H. Foam Sealants: Blown with hydrocarbon or HFC-134a.

2.3 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type C: Closed-cell material with a surface skin.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints. Leave no residue.

PART 3 – EXECUTION

3.1 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.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:

    a. Concrete.

    b. Masonry.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

    a. Metal.

    b. Glass.

c. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated

C. Install sealant backings of type indicated to support 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.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.

E. Install sealants by proven techniques to comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses provided for each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

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.

3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Contractor will engage a qualified testing agency to perform tests and inspections.

1. **No sealant work is to be completed without prior written authorization from the Architect that the field adhesion test has been completed.**

B. Field-Adhesion Testing: Perform adhesion tests in accordance with manufacturer's instructions and with ASTM C1193, Method A.

1. Perform 5 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate, and one test for each 1000 feet of joint length thereafter or 1 test per each floor per building elevation, minimum.

2. For sealant applied between dissimilar materials, test both sides of joint.

C. Remove sealants failing adhesion test, clean substrates, reapply sealants, and re-test. Test adjacent sealants to failed sealants.

D. Submit report of field adhesion testing to Architect indicating tests, locations, dates, results, and remedial actions taken.

3.5 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

B. Remove and recycle all excess material in accordance with Division 1 Sections.

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.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of

Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES

PART 1 – GENERAL

1.1 SUMMARY

A. Extent of metal doors and frames is shown and scheduled on drawings and includes the following:

1. Hollow metal doors and frames, field finished

B. Related Sections include the following:

1. Division 7 Section “Joint Sealants”

2. Division 8 Section “Flush Wood Doors”

3. Division 8 Section “FRP – Aluminum Hybrid Doors”

4. Division 8 Section “Glazing”

5. Division 8 Section “Door Hardware”

6. Division 9 Section “Painting and Coating”

1.2 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.

1.3 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.

1.4 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

2.1 MANUFACTURERS

A. Curries Company

B. Ceco Door Products

C. Steelcraft Manufacturing Company

D. Metal Products Incorporated

E. Republic Doors & Frames

F. Or equal

2.2 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.

2.3 COMPONENTS

A. Steel Doors:

1. Provide flush metal doors indicated on drawings or schedules, complying with requirements for SDI Level 3, Model 2 (16 gauge, extra 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 sub-paragraph "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).

D. Standard Steel Frames:

1. Provide 16 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.

2.4 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). <u>All items in exterior doors to be galvanized.</u>

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.

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.

2.5 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.

B. Field Application:

1. Prior to application of **ANY** hardware, frames and doors shall be re-primed, and coated with 2 coats of finish paint in accordance with Division 9 Section “Painting and Coating”.

2. Hardware and doors are not to be installed until **ALL** painting has been completed.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Installer must examine substrate and conditions under which steel doors and frames are to be installed and must notify Architect 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.

3.2 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.

3.3 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

SECTION 08 14 16 – FLUSH WOOD DOORS

PART 1 – GENERAL

1.1 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 “Hollow Metal Doors and Frames”

2. Division 8 Section “Door Hardware”

3. Division 8 Section “Glazing”

1.2 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.

1.3 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"

1.4 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.

1.5 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.

1.6 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

2.1 MANUFACTURERS

A. Masonite Architectural (Graham, Marshfield-Algoma, Mohawk)

B. VT Industries (Eggers Industries)

C. Oshkosh Door Company

2.2 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-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.

2.3 INTERIOR SOLID CORE DOORS

A. Grade: Custom, with Grade A faces.

B. Species: select white birch

C. Cut: plain sliced

D. Match between Veneer Leaves: Book match.

E. Panel match: running match.

F. Pair and Set Match: Provide for doors hung in same opening.

G. Core: Particleboard (LD-2) 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.

2.4 ACCESSORIES

A. Glazing:

1. 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.

2.5 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.

a. Glazing: Comply with applicable requirements in Division 8 Section “Glazing."

2. Louvers: Factory install louvers in prepared openings.

2.6 FINISHES

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including 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: AWI Custom Grade

2. Finish: Manufacturer's standard UV cured polyurethane, equal to WDMA TR-6 catalyzed polyurethane.

3. Staining: As selected by Architect from manufacturer's standard.

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

3.1 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.

3.2 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 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.

3.3 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.

3.4 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 Architect 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 Trade Contractor’s 1-year warranty, the Contractor shall perform a walk-thru, with the Architect present, 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 17 43 – FRP – ALUMINUM HYBRID DOORS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes

1. Fiberglass reinforced polyester (FRP) / aluminum hybrid flush doors

2. Aluminum frames.

B. Related Sections include the following:

1. Division 8 Section “Hollow Metal Doors and Frames”

2. Division 8 Section “Door Hardware”

1.2 PERFORMANCE REQUIREMENTS

A. Face Sheet:

1. Standard Interior and Exterior Class C 0.120” thick, Sandstone texture, through color FRP sheet.

a. Flexural Strength, ASTM-D790: 27 x 10^3 psi.
b. Flexural Modulus, ASTM-D790: 0.7 x 10^6 psi.
c. Tensile Strength, ASTM-D638: 18 x 10^3 psi.
d. Tensile Modulus, ASTM-D638: 1.0 x 10^6 psi.
e. Barcol Hardness, ASTM-D2583: 40.
f. Izod Impact, ASTM-D256: 7.0 ft-lb/in.
g. Gardner Impact Strength, ASTM-D5420: 30 in-lb.
h. Water Absorption, ASTM-D570: 0.16%/24hrs at 77°F.
i. Surface Burning, ASTM-E84: Flame Spread ≤ 200, Smoke Developed ≤ 450.
j. Chemical Resistance: Excellent Rating.

B. Door Core:

1. Density, ASTM-D1622: ≤ 5.0 pcf.
2. Compressive Properties, ASTM-D1621: Compressive Strength ≥ 60 psi, Compressive Modulus ≥ 1948 psi.
3. Tensile and Tensile Adhesion Properties, ASTM-D1623: Tensile Adhesion, 3” x 3” FRP Facers ≥ 53 psi, Tensile Adhesion, 1” x 1” Foam ≥ 104 psi.
4. Thermal and Humid Aging, ASTM-D2126: Volume Change at 158 °F, 100% humidity, 14 days ≤ 13%.
5. Thermal Conductivity, ASTM-C518, Thermal Resistance ≥ 0.10 m^2K/W.

C. Door and Thermally Broken Aluminum Frame Assembly:

1. Thermal Transmittance, NFRC 100:

a. Commercially Glazed Swinging Entrance Door (> than 50% glass)
1.) U-Factor = 0.62 Btu/hr·ft²·°F.

2. Air Leakage, NFRC 400, ASTM-E283:

a. Commercially Glazed Swinging Entrance Door (> than 50% glass)

1.) 0.22 cfm/sqft @ 1.57 psf.
2.) 0.42 cfm/sqft @ 6.24 psf.

3. Sound Transmission, ASTM-E90: STC = 30, OITC = 30.

1.3 SUBMITTALS

A. Action Submittals/ Informational Submittals:

1. Product Data: Submit manufacturer's product data sheets, catalog pages illustrating the products, description of materials, components, fabrication, finishes, installation instructions, and applicable test reports.

2. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, and finish.

3. Samples

a. Submit manufacturer's door sample composed of door face sheet, core, framing and finish.

b. Submit manufacturer's sample of standard colors for door face and frame.

4. Operation and Maintenance Manual: Submit manufacturer's maintenance and cleaning instructions for doors and frames, including maintenance and operating instructions for hardware.

5. Warranty Documentation: Submit manufacturer's standard warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years concurrent successful experience.

2. Door and frame components must be fabricated by same manufacturer.

3. Evidence of a documented complaint resolution quality management system.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Deliver materials to site in manufacturer's original, unopened, containers and packaging.

2. Labels clearly identifying opening, door mark, and manufacturer.

B. Storage: Store materials in a clean, dry area, indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials and finish from damage during handling and installation.

1.6 WARRANTY

A. Warrant doors, frames, and factory installed hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.

B. Standard: Ten years starting on date of shipment, unless noted otherwise for a longer duration below.

1. Construction Lifetime: Covers failure of corner joinery, core deterioration, and delamination or bubbling of door skin and corrosion of all-fiberglass products while the door is in its specified application in its original installation.

2. Finish:

a. SL-20 face sheets: 10 years.

b. Anodized, aluminum:10 years.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Special-Lite, Inc.

B. Equal as approved.

2.2 MATERIALS

A. Aluminum Members:

1. Aluminum extrusions made 6061 or 6063 aluminum alloys.

2. Sheet and plate to conform to ASTM-B209.

3. Alloy and temper to be selected by manufacturer for strength, corrosion resistance, and application of required finish, and control of color.

B. Fasteners:

1. All exposed fasteners will have a finish to match material being fastened.

2. 410 stainless steel or other non-corrosive metal.

3. Must be compatible with items being fastened.

2.3 MANUFACTURED UNITS

A. Provide "SL-20 Sandstone Texture FRP/ Aluminum Hybrid Door installed in Thermally Broken Aluminum Framing" as manufactured by Special-Lite or approved equal.

B. Construction:

1. Door Thickness: 1-3/4".

2. Stiles & Rails:

a. Aluminum extrusions made from 6063 aluminum alloys with a minimum temper of T5.

b. Minimum 2-5/16" deep one-piece extrusion with have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.

c. Screw or snap in place applied caps are not acceptable.

d. Top rails must have integral legs for interlocking continuous extruded aluminum flush cap.

e. Bottom rails must have integral legs for interlocking continuous weather bar with single nylon brush weather stripping or manually adjustable SL-301 door bottom with two nylon brush weather stripping.

f. Meeting stiles to include integral pocket to accept pile brush weather seal.

3. Corners:

    a. Mitered

    b. Secured with 3/8” diameter full-width steel tie rod through extruded splines top and bottom which are integral to standard tubular shaped rails.

    c. 1-1/4” x 1-1/4” x 3/16” 6061 aluminum angle reinforcement at corner to give strong, flat surface for locking hex nut to bear on.

    d. Weld, glue, or other methods of corner joinery are not acceptable.

4. Core:

    a. Poured-in-place polyurethane foam.

    b. Laid in foam cores are not acceptable.

    c. Foam Plastic Insulated Doors: IBC 2603.4.

    d. Foam plastic shall be separated from the interior of a building by an approved thermal barrier.

    e. Approved thermal barrier must meet the acceptance criteria of the Temperature Transmission Fire Test and Integrity Fire Test as stated in NFPA 275.

    f. IBC 2603.4.1.7 foam plastic insulation, having a flame spread index less than 75 and a smoke developed index of not more than 450 shall be permitted as a door core when the face is metal minimum 0.032” aluminum or 0.016” steel.

    g. Standard door assembly can be tested to show it meets these requirements without the use of thermal barrier. If no independent testing conducted all doors with foam plastic core must have a thermal barrier.

5. Face Sheet:

    a. Interior and Exterior:

        (1) 0.120” thick, Sandstone texture, through color FRP sheet.

        (2) Class C standard.

    b. Attachment of face sheet:

        (1) Extruded stiles and rails to have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.

(2) Use of glue to bond face sheet to core or extrusions is not acceptable.

6. Cutouts: Manufacture doors with cutouts for required vision lites, louvers, and panels.

7. Hardware:

   a. Pre-machine doors in accordance with templates from specified hardware manufacturers.

   b. Surface mounted closures will be reinforced for but not prepped or installed at factory.

8. Reinforcements:

   a. Aluminum extrusions made from 6061 or 6063 aluminum alloys.

   b. Sheet and plate to conform to ASTM-B209.

   c. Alloy and temper to be selected by manufacturer for strength, corrosion resistance, and application of required finish, and control of color.

   d. Bars and tubes to meet ASTM-B221.

2.4 FRAMING

A. Thermally Broken:

1. Provide "SL-450TB Thermally Broken Aluminum Framing" as manufactured by Special-Line or equal.

   a. Perimeter Frame Members:

      (1) Storefront frame with thermally broken pocket filler.
      (2) Factory fabricated.
      (3) Open-back framing is not acceptable.

   b. Thermal Strut: Fiber reinforced plastic.

   c. Applied Door Stops:

      (1) 5/8" x 1-1/4" or 5/8" x 1-3/4", 0.125" wall thickness, with screws and weather-stripping.
      (2) Provide solid ½" aluminum bar behind door stop for closer shoe attachment.
      (3) Pressure gasketing for weathering seal.
      (4) Counterpunch fastener holes in door stop to preserve full-metal thickness under fastener head.
      (5) Minimum ½" aluminum bar reinforcement under doorstop for required hardware attachments, aluminum to meet ASTM-B221.

d. Caulking: Caulk joints before assembling frame members.

e. Frame Member to Member Connections:

(1) Secure joints with fasteners.
(2) Provide hairline butt joint appearance.
(3) Shear block construction only, no screw spline allowed.

f. Hardware:

(1) Pre-machine and reinforce frame members for hardware in accordance with manufacturer's standards and door hardware schedule.
(2) Surface mounted closures will be reinforced for but not prepped or installed at factory.
(3) Factory install door hardware.

g. Anchors:

(1) Anchors appropriate for wall conditions to anchor framing to wall materials.
(2) Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.
(3) Secure head and sill members of transom, side lites, and similar conditions.

2.5 FABRICATION

A. Factory Assembly

1. Door and frame components from the same manufacturer.

2. Required size for door and frame units, shall be as indicated on the drawings.

3. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.

4. All cut edges to be free of burs.

5. Welding of doors or frames is not acceptable.

6. Maintain continuity of line and accurate relation of planes and angles.

7. Secure attachments and support at mechanical joints with hairline fit at contact surfaces.

B. Shop Fabrication

1. All shop fabrication to be completed in accordance with manufactures process work instructions.

2. Quality control to be performed before leaving each department.

2.6 FINISHES

A. Door:

1. Aluminum: Anodized Aluminum AA-M10C21A44 / AA-M45C22A44 Architectural Class I (.7 mils minimum)

a. Color: Dark Bronze

2. FRP Face Sheets: Through color, as selected by the Architect.

B. Frame

1. Aluminum: Anodized Aluminum AA-M10C21A44 / AA-M45C22A44 Architectural Class I (.7 mils minimum)

a. Color: Dark Bronze

2.7 ACCESSORIES

A. Vision Lites:

1. Special Lite “FL Standard”

2. Factory Glazing Thickness: 9/16” impact - as indicated in Division 8 Section “Glazing”.

B. Hardware:

1. Pre-machine doors in accordance with templates from specified hardware manufactures and hardware schedule.

2. Hardware Schedule:

a. Provide per below and as specified in Division 8 Section “Door Hardware”:

(1) Hinges: Hager “BB1191”

(2) Concealed adjustable bottom brush: Special Lite “SL-301”.

(3) Mullions: Special Lite “SL-60 removable aluminum mullion”

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas to receive doors.

B. Notify architect of conditions that would adversely affect installation or subsequent use.

C. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.3 ERECTION

A. Install doors in accordance with manufacturer's instructions.

B. Install doors plumb, level, square, true to line, and without warp or rack.

C. Anchor frames securely in place.

D. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by architect.

E. Set thresholds in bed of mastic and back seal.

F. Install exterior doors to be weathertight in closed position.

G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by architect.

H. Remove and replace damaged components that cannot be successfully repaired as determined by architect.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services.

1. Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

3.5 ADJUSTING

A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.6 CLEANING

A. Clean doors promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that would damage finish.

3.7 PROTECTION

A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 08 31 00 – ACCESS DOORS AND PANELS

PART 1 – GENERAL

1.1 SUMMARY

A. Provide factory fabricated doors as shown on the Drawings and as specified herein:

1. Ceiling mounted, fire rated, gypsum board recessed

B. Related Sections include the following:

1. Division 8 Section “Door Hardware” for cylinder requirements.

2. Division 9 Section “Gypsum Board”

1.2 SUBMITTALS

A. Product Data indicating materials, finishes, size and configuration.

B. Shop Drawings: Show profiles, accessories, location, dimensions and details to adjacent construction.

1.3 QUALITY ASSURANCE

A. Size Variations: Obtain Architects acceptance of manufacturer’s standard size units which may vary slightly from sizes indicated.

B. Coordination:

1. Furnish inserts and anchoring devices which must be built into other work for installation of access doors.

2. Coordinate delivery with other work to avoid delay.

1.4 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered in manufacturer’s original packaging. Store materials in a dry, protected, well-vented area.

B. Remove protective wrapping immediately after installation.

1.5 WARRANTY

A. Manufacturer's standard warranty: Materials shall be free of defects in material and workmanship for a period of (25) twenty five years.

1. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acudor Access Panels

B. The Bilco Company

C. Nystrom Building Products

D. J.L. Industries

E. Babcock-Davis

2.2 CEILING MOUNTED, FIRE RATED, GYPSUM BOARD RECESSED

A. Provide "Model FW-5050-DW" recessed access panel with mortise prep as manufactured by Acudor.

1. Insulated fire door with concealed hinge, self-closing, self-latching, with door face recessed 5/8 inch for gypsum board infill, with exposed flange and concealed hinge.

2. Door / Door Frame: Steel or Stainless Steel: 20 gauge door,16 gauge mounting frame

3. Door filled with 2" thick fire rated insulation, flange to be galvanized steel drywall taping bead flange.

4. Hinge: Concealed

5. Latch and Lock: Prepared for mortise cylinder – provide cylinder and core per Division 8 Section "Door Hardware".

6. Fire Rating (Ceilings): Warnock Hersey International 3 hour rated in a non-combustible ceiling. 1 hour rated in a combustible ceiling.

7. Finish: Steel: 5 stage iron phosphate preparation with prime coat of white baked-on enamel.

2.3 FABRICATION

A. Manufacture each access panel assembly as an integral unit ready for installation.

B. Welded construction: Furnish with a sufficient quantity of 1/4” mounting holes to secure access panels to types of supports indicated.

C. Recessed panel: Form face of panel to provide specified recess for application of finish material. Reinforce panel as required to prevent buckling.

D. Furnish number of latches required to hold door in flush smooth pane when closed.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Mounting surfaces shall be straight and secure; substrates shall be of proper width.

B. Do not proceed until any unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install per the construction documents, shop drawings, and manufacturer’s installation instructions.

B. Install frames plumb and level in opening, in proper alignment with floor surface for flush installation. Secure rigidly in place.

C. Position units to provide convenient access to concealed Work requiring access.

D. Remove PVC protectant off of hatch covers and frames after installation. Leave protectant on unit until concrete pouring operations in pan and adjacent to floor hatch have taken place.

3.3 ADJUSTING

A. Adjust latching mechanism to operate smoothly.

B. Remove and replace panels or frames which are bowed, warped or damaged.

END OF SECTION

SECTION 08 41 13 – ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 – GENERAL

1.1 SUMMARY

A. Extent of entrance and storefront work is indicated on the Drawings

B. Work includes, but is not limited to the following:

1. Impact Resistant, aluminum storefront system

2. Impact Resistant aluminum entrance units including hardware

3. Interior storefront and entrance system

4. Door hardware for all aluminum entrances

5. Frame, transoms and sidelights where indicated.

6. Breakmetal closures at heads, jambs, and sills as indicated on Drawings.

7. Accessories including perimeter trims, stools, accessories, shims, anchors and perimeter sealing of framing units to create an air and weathertight seal.

8. Coordination of door hardware with Division 8 Section “Door Hardware” subcontractor to ensure compatibility of all system components.

C. Related Sections include the following:

1. Division 7 Section “Sheet Metal Flashing and Trim”

2. Division 7 Section “Joint Sealants”

3. Division 8 Section “Door Hardware”

4. Division 8 Section “Glazing”

1.2 PERFORMANCE REQUIREMENTS

A. Wind loads: Design and size components to withstand dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall, including building corners, in accordance with code requirements.

B. Wind Design Data:

1. Design pressure: +/-60 psf.

2. Windborne-Debris-Impact Resistance Performance: Shall be tested in accordance with ASTM E1886, information in ASTM E1996, and TAS

201/203.

a. Large & Small Missile Impact: For all aluminum-framed systems in this project.

C. Air Leakage: The test specimen shall be tested in accordance with ASTM E 283. Air Leakage rate shall not exceed 0.06 cfm/ft2 at a static air pressure differential of 6.2 psf with interior seal, or, rate shall not exceed 0.06 cfm/ft2 at a static air pressure differential of 1.6 psf without interior seal.

D. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 12 psf as defined in AAMA 501.

E. Uniform Load: A static air design load of 65 psf shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/180 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.4% of their clear spans shall occur.

1.3 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.

B. Shop Drawings:

1. Submit all data developed by the contractor for the purposes of fabrication and assembly assemblies. Include framing system and all associated components of the 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.

1.4 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. Detailed review of Contract Documents and approved shop drawings.

b. Weather conditions under which work will be done.

c. Anticipated frequency and extent of joint movement.

d. Joint design.

e. Glazing procedures.

3. Sign off from the manufacturer that site conditions are acceptable is required in writing prior to start of Work.

1.5 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.

1.6 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.

1.7 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.

1.8 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.

1. Coordinate with Division 8 Section “Door Hardware”.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Kawneer North America (Basis of Design)

B. The following manufacturers are considered equal systems. If the following are used, any changes to the building design or construction (including hardware changes) shall be at **no cost** to the Owner.

1. Oldcastle Building Envelope

2. EFCO Corporation

3. YKK AP America, Inc.

2.2 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. 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”)

D. Fasteners:

1. Clamping bars shall be attached to glazing bars by ¼ - 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.

E. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.

F. Shims: Non-staining, non-ferrous, type as recommended by system manufacturer.

G. 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.

H. Glass: Provide glazing as specified in Division 8 Section “Glazing”.

I. Gaskets: Glazing gaskets shall comply with ASTM C 864 and be extruded of a silicone compatible EPDM rubber that provides for silicone adhesion.

J. Sealants: as recommended by manufacturer for joint type for a complete system warranty, and as follows:

1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.

2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.

3. Refer to Division 7 Section “Joint Sealants” for adhesion testing prior to installation.

2.3 EXTERIOR STOREFRONT COMPONENTS

A. Impact Resistant Storefront (Center Plane, Screw Spline):

1. Provide “IR501 Framing System” as manufactured by Kawneer.

B. Framing Member Profile: minimum 2-1/2" x 5" nominal dimension. Provide in greater widths if required by manufacturer to meet wind loading.

1. Provide high performance aluminum subsill at all openings.

C. Provide all necessary components for complete installation including glazing gaskets for flush glazing and adapters as required to accommodate the following:

1. 1-5/16” impact glazing as specified in Division 8 Section “Glazing”.

2.4 ENTRANCE COMPONENTS

A. Standard impact entrances (exterior):

1. Provide “350 IR” as manufactured by Kawneer.

B. Standard entrances (interior only):

1. Provide “350” as manufactured by Kawneer.

C. All door sections shall be of extruded aluminum alloy and temper to meet or exceed finishing and structural criteria as specified.

D. Doors shall be 1-3/4 inches thick. Major portions of the door members to be 0.125” nominal in thickness.

E. Glazing gaskets shall be either EPDM elastomeric extrusions or a thermoplastic

elastomer.

F. Fasteners: aluminum alloys or stainless steel. Exposed fasteners, if any, shall be finished to match door and frame sections.

G. Provide all necessary components for complete installation including glazing gaskets for flush glazing and adapters as required to accommodate the following:

1. Exterior: 9/16” impact glazing as specified in division 8 section “Glazing”.

2. Interior: 1/4” glazing as specified in division 8 section “Glazing”.

H. Hardware:

1. It is the responsibility of the storefront contractor and Door Hardware provider thru the General Contractor to ensure all hardware submitted is compatible with their most current assembly test for impact resistance.

a. Manufacturer to submit letter stating all hardware provided meets assembly testing for large and small missile impact testing.

2. Hardware sets: included at the end of this Section.

3. All other hardware to be provided per Division 8 Section “Door Hardware”.

a. Where electromechanical hardware is to be provided in lieu of mechanical hardware, coordinate with Door Hardware Contractor and Electrical Contractor for all necessary rough-ins, components, and wiring for a complete working installation.

4. Weatherstripping: manufacturer’s standard in addition to specified in Division 8 Section “Door Hardware”.

2.5 INTERIOR STOREFRONT

A. Provide equal to “Trifab VersaGlaze 450” as manufactured by Kawneer.

B. Framing Member Profile:

1. Typical: 1-3/4" x 4-1/2” nominal dimension, center set glazing.

a. Provide 4-1/4” sill where indicated on 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”.

2.6 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".

2.7 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.

2.8 FINISHES

A. All exposed surfaces shall be free of unsightly scratches and blemishes.

B. Equal to Kawneer “Permanodic” #40 Dark Bronze:

1. Anodized Aluminum AA-M10C21A44 / AA-M45C22A44 Architectural Class I (.7 mils minimum)

PART 3 – EXECUTION

3.1 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.

3.2 INSTALLATION

A. Install 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: 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. Refer to Division 7 Section “Sheet Metal Flashing and Trim”.

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. Coordinate hardware installation with Division 8 “Door Hardware” to ensure all hardware is 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.

3.3 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.

3.4 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.

3.5 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.

3.6 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.

3.7 HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. Quantities listed are for each pair of doors, or for each single door.

C. The supplier is responsible for handing and sizing all products.

D. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

E. Weatherstripping: manufacturer's standard in addition to specified below in hardware sets.

F. Refer to Division 8 Section "Door Hardware" for detailed descriptions of hardware components (located in Part 2).

HARDWARE SET: AL-01

END OF SECTION

SECTION 08 45 13 – STRUCTURED POLYCARBONATE PANEL ASSEMBLIES

PART 1 – GENERAL

1.1 SUMMARY

A. Structured Polycarbonate panel assemblies.

B. Related Sections include the following:

1. Division 1 Section “Alternates”

2. Division 1 Section “Special Requirements”

1.2 DESIGN REQUIREMENTS

A. Framing Members: Sufficient sizes as required to support design loads.

B. Deflection Limits: Combined maximum deflection < 1”

C. Expansion and Contraction: Design and install components with provisions for expansion and contraction due to a 100 degree F (56 degrees C) temperature variation.

D. Design Loads: Framing components shall be designed to support the following loads:

1. Design pressure: +/-60 psf.

E. Design Calculations: provide calculations prepared and stamped by a registered professional engineer, qualified in the design of wall systems and licensed in the state where system is to be installed.

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including preparation instructions and recommendations, storage and handling requirements, installation methods and maintenance instructions.

B. Shop Drawings: Include plans, elevations, sections, and details, indicating dimensions, tolerances, profiles, anchorage, connections, fasteners, provisions for expansion and contraction, drainage, flashing, finish, glazing, and attachments to other Work.

C. Samples: Submit samples as requested for each glazing, framing system, finish, and color specified.

D. Design Data:

1. Submit manufacturer's structural calculations showing sizes of framing members and loads applied to supporting structure based on design loads.

2. Submit required signed and sealed structural calculations prepared by a qualified professional engineer who is licensed in the state where system is to be installed.

E. Manufacturer's Certificates: Submit documentation in writing certifying that products meet or exceed the specified requirements.

F. Test Reports: Submit test data indicating that wall systems comply with specified requirements. Submit results from the following:

1. Flame spread and smoke development, ASTM E 84.
2. Burn extent, ASTM D 635.
3. Self-ignition, ASTM D 1929.
4. Air infiltration, ASTM E 283.
5. Water penetration, ASTM E 331.
6. Uniform load deflection, E 330.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum ten years documented experience in the fabrication of daylighting systems and capable of providing field service representation during installation.

B. Installer Qualifications: Experience with daylighting systems and trained by manufacturer’s standard methods and policies, specializing in work similar to project requirements and approved by manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name, manufacturer, and installation location.

B. Do not stack stored sheets in direct sunlight.

C. Storage/Handling: Store products above the floor and under cover in a clean, dry area until installation. Protect materials and finish from during handling and installation - do not slide, drag or drop polycarbonate sheets as this may cause damage.

1.6 SITE CONDITIONS

A. 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 recommended limits.

1.7 WARRANTY

A. Weatherization: Provide manufacturer’s written warranty covering Delta E (less than 10 delta after 10 years), loss of light transmission compared to original (no greater than 6% loss after 10 years) and loss of impact resistance due to typical atmospheric conditions.

1. Provide manufacturer's standard 10 year warranty.

B. Metal Finishes:

1. Anodize: Provide manufacturer's standard 5 year.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Major Industries Inc. (Kingspan)

B. Equal as approved

2.2 MANUFACTURED UNITS

A. Provide “IlluminPC Polycarbonate Wall System” polycarbonate multi-wall panels as manufactured by Major Industries or approved equal.

1. Thickness: 1.57 inches.

a. Panel Maximums: 19-11/16 inches wide / 20 feet long.

(1) Panel U-factor: 0.19 / System U-factor: .34

b. Appearance:

(1) Tongue and groove profile, multi-wall construction.

(2) Color change shall not exceed 10 Delta E units after 10 years of weathering
(in accordance to ASTM D 1925 standard).

(3) Color: Opal (White) (44% LT)

c. Panel Attributes:

(1) Flame Spread, ASTM E 84: <25 – Class A.

(2) Smoke Development, ASTM E 84: <450 – Class A.

(3) Burn Rate, ASTM D 635: 1.0 inch per minute maximum - CC1.

(4) Self-Ignition, ASTM D 1929: 986 degrees F.

B. Components, Perimeter Framing and Accessories:

1. Aluminum:

a. Extruded Aluminum: ASTM B 221, Alloy 6063-T5/T6, 6061-T5/T6.

b. Formed Aluminum Components and Flashing: ASTM B 209, Alloy 5005-H34.

c. Thermal Break: Poured and debridged structural polyurethane.

2. Glazing Gaskets: Factory provided foam weather-strip.

3. Sealant Tape: Aluminum tape, anti-dust tape or equal.

C. Fasteners:

1. Attachment Clips: Aluminum.

2. Construction and Glazing Cap Fasteners: 18-8 stainless steel

3. Field Anchors: Cadmium plated, unless otherwise specified.

2.3 FABRICATION

A. Wall system framing constructed of extruded aluminum shapes similar to sections indicated on Drawings.

B. Weep Holes in Sill Components: Completed on-site according to installation instructions to control condensation that may enter system by allowing it to pass to the exterior.

2.4 FINISHES

A. Anodized Coating: Architectural Class I pigmented anodized, Type AA-M10C22A42/A44.

1. Color: Dark Bronze

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas to receive polycarbonate multi-wall system, including supporting structure and substrate for dimensions, tolerances, material conditions, and support, and notify Architect of conditions that would adversely affect installation or subsequent utilization of wall system. Do not proceed until conditions are corrected.

3.2 PREPARATION

A. Ensure supports to receive wall system are clean, flat, level, plumb, and square.

B. Aluminum Protection: Where aluminum will contact dissimilar materials, apply a coating of bituminous paint or other neutral material or separate with a nonabsorbent isolator.

3.3 INSTALLATION

A. Install wall systems level, plumb, square, and accurately aligned, and in accordance with manufacturer's instructions at locations indicated on the approved drawings. Do not install wall system components with deficiencies or dimensional errors or proceed with installation until unsatisfactory components are replaced.

B. Anchor wall system securely to supports using attachment methods that permit adjustment for construction tolerances, irregularities, alignment, and expansion and contraction.

C. Install wall system per installation manual, including flashings, fasteners, hardware, sealants, and glazing materials required for a complete, weatherproof installation.

D. Remove any temporary interior protective coverings at time of installation and any exterior coverings after each panel is installed.

3.4 FIELD QUALITY CONTROL

A. Repair or replace work that does comply with specified requirements and retest work.

B. Examine installation of sheet metal flashing and sealants, and examine all panels for cracks, deep scratches, and other damage. Repair or replace in accordance with manufacturer's instructions and as approved.

3.5 CLEANING

A. Clean wall system inside and outside, including member connections and inside corners, immediately after installation and after sealants have cured, but not more than 10 days after installation.

B. Follow related cleaning instructions in accordance with manufacturer's recommendations.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08 60 00 – SKYLIGHTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish all labor and materials for furnish and installation of skylight system as specified herein and includes the following.

1. Thermal aluminum vinyl frame system.

2. Glazing and glazing gaskets.

3. Factory installation or installation by factory approved contractor with site supervision as required.

B. Related Sections include the following:

1. Division 7 Section “Asphalt Shingles”

2. Division 7 section “Joint Sealants”

1.2 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. Indicate materials, finishes and installation procedures recommended by manufacturer.

4. Indicate compliance with specified design criteria.

5. Indicate compliance with performance requirements.

6. Include product specific glazing details.

B. Shop Drawings:

1. Indicate material types, gauges and finishes, fabrication details and installationdetails.

2. Show glazing types, methods of attachment and thermal movement provisions.

C. Indicate compliance with specified structural design criteria.

1. Submitted design calculations shall bear seal of a professional engineer licensed in the State of Mississippi.

2. Certify that engineer has reviewed shop drawings.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square, representing actual product, color, and patterns.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Skylight manufacturer shall have a minimum of five years experience in skylight manufacturing, qualified by having performed similar work and having experienced workmen to perform work of type required by contract documents and licensed where appropriate.

B. Installer Qualifications:

1. Installer shall be trained and approved by manufacturer.

2. Installer shall have five years experience with skylight type, size and complexity.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.5 PROJECT CONDITIONS

A. 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.

1.6 WARRANTY

A. Skylights are guaranteed for a period of 5 years from date of purchase against defects in materials or workmanship.

B. The guarantee is limited to repair or replacement, at manufacturer's discretion, and does not cover freight, installation, or consequential damages.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:

1. Artistic Skylight Domes Ltd. www.artisticskylight.com

2. Equal as approved

2.2 SKYLIGHT PERFORMANCE

A. Load:

1. Deflection of framing members shall not exceed L/180 or 1 inch whichever is less.

2. Acrylic and/or polycarbonate unit skylights shall meet the requirements of uniform load test ASTM E330 that requires glazing to withstand a positive and negative test pressure of 60 psf.

B. Air Infiltration:

1. Acrylic and/or polycarbonate unit skylights shall meet the requirements of ASTM E283 that allows a maximum air infiltration of 0.06 cfm (.0017 cu. m/m) of the total glazed surface area.

C. Water Infiltration:

1. Acrylic and/or polycarbonate unit skylights shall meet the requirements of ASTM E547/E331 that allows for no water infiltration at a test pressure of 12 psf (571 Pa).

2.3 SELF FLASHING SKYLIGHTS

A. Product: Vinyl Base Frame Model PVCSR as manufactured by Artistic Skylight Domes Ltd.

1. The skylight shall consist of rigid high-impact extruded vinyl base frame (superior in thermal conductivity to aluminum) which incorporates a high capacity, 8 degree sloped condensation gutter with drainage to exterior, co-extruded rubber draft seal, and 3 inches mounting flange. Retaining cap frame shall be extruded, mill finish (optional baked enamel), 6063-T5 aluminum alloy with heliarc welded corners.

2. Glazing shall consist of sealed insulated glass domes.

2.4 MATERIAL

A. Framing systems shall be extruded aluminum, 6063-T5 alloy, with extruded rigid vinyl thermal break.

B. Exposed aluminum surfaces shall be standard mill finish or brown or clear anodized. Custom finishes and colors as scheduled or indicated.

C. Sealants, as designated on drawings, shall be neutral cure architectural grade silicone.

D. Fasteners shall be stainless steel or cadmium plated steel. Exposed fasteners to match specified color of adjacent aluminum.

E. Gaskets to be continuous co-extruded vinyl, neoprene, EPDM, or Santoprene rubber held with constant pressure.

F. Glazing shall be:

G. Glass Performance:

1. Glass glazed systems shall be double glazed of thickness and colors as required by design criteria.

2. Insulated gray tempered with Low E coating over laminated glass to meet impact resistance.

2.5 FABRICATION

A. Skylights shall be factory assembled and shipped as such. Work which cannot be permanently assembled will be shipped in pre-assembled sections to minimize field assembly.

PART 3 EXECUTION

3.1 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.

3.2 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.

3.3 INSTALLATION

A. Installer shall inspect area to receive skylights to determine that the conditions are in accordance with shop drawings and specifications. Any variance shall be recorded in writing and corrections made before beginning installation.

B. Installation shall be in strict accordance with these specifications and the manufacturers shop drawings and installation instructions.

C. All materials provided by installer shall be in accordance with those shown on the shop drawings.

3.4 PROTECTION

A. Installer shall remove all labels and protective packaging from components and shall leave the installation free of all heavy construction dirt and sealant smears.

B. Final cleaning and physical protection of all installed materials shall be performed by the general contractor.

C. Protect installed products until completion of project.

D. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Flush Wood Doors”.
3. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
4. Division 28 Section “Access Control Hardware Devices”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI/SDI A250.13 - Testing and Rating of Severe Windstorm Resistant Components for Swing Door Assemblies.
3. ASTM E1886 - Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials.
4. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure difference.
5. ASTM E1996 - Standard specification for performance of exterior windows, curtain walls, doors and storm shutters impacted by Windborne Debris in Hurricanes.
6. ICC/IBC - International Building Code.
7. NFPA 70 - National Electrical Code.
8. NFPA 80 - Fire Doors and Windows.
9. NFPA 101 - Life Safety Code.
10. NFPA 105 - Installation of Smoke Door Assemblies.
11. TAS-201-94 - Impact Test Procedures.
12. TAS-202-94 - Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components using Uniform Static Air Pressure.
13. TAS-203-94 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.
14. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.2 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the 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 Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified and authorized provider of the primary Integrated Wiegand Access Control Products.

E. Proof of Qualification: Provide copy of manufacturer(s) Factory Trained Installer documentation indicating proof of status as a qualified installer of Windstorm assemblies.

F. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

G. Informational Submittals:

1. Hurricane Resistant Openings: Exterior hurricane opening assemblies to be tested according to ASTM E330, ASTM E1886, ASTM E1996 standards, and certified by a qualified independent third party testing agency acceptable to authority having jurisdiction, with labeling indicating compliance with the wind load and design pressure level requirements specified for the Project.

2. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

H. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.3 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1. All installers shall be full time employees of the supplier (or subcontractors of the supplier) of the hardware and trained and approved by lock manufacturer. Installer shall have minimum 3 years' experience in installation of similar hardware that is required for this Project.

2. **The General Contractor or other subcontractors may not install hardware. If any hardware is installed, it will be considered non-conforming.**

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Windstorm Assembly Installer Qualifications: Installers are to be factory trained for shop and field installation prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project. A pre-installation site inspection of the frame and floor conditions shall be conducted by the factory trained installer prior to any Windstorm assembly hardware applied to the opening.

F. Integrated Wiegand, Wireless, and IP-Enabled Access Control Products Supplier Qualifications: Integrated access control products and accessories are required to be supplied and installed through current members of the ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) programs. Suppliers are to be factory trained, certified prior to project bid, and a direct purchaser of the specified product. Installers are to be factory trained, certified prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project.

G. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

H. Hurricane Resistant Exterior Openings: Provide exterior door hardware as complete and tested assemblies, or component assemblies, including approved doors and frames specified under Section 081113 "Hollow Metal Doors and Frames", to meet the wind loads, design pressures, debris impact resistance, and glass and glazing requirements applicable to the Project.

1. Test units according to ASTM E330, ASTM E1886, ASTM E1996 standards, certified by a qualified independent third party testing agency acceptable to authority having jurisdiction, and bearing a third party certification agency permanent label indicting windstorm approved product.

I. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

J. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

K. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

L. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

M. Comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:

1. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
2. Door Closers: Comply with the following maximum opening-force requirements indicated:
    a. Interior Hinged Doors: 5 lbf applied perpendicular to door.

3. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.

N. Pre-Installation Conference: Contractor, Supplier, and installing Sub-Contractor shall set up and attend meeting with Architect to review proper methods and the procedures for receiving, handling, and installing door hardware.
1. Prior to installation of door hardware, conduct a project specific meeting to review the proper installation and adjustment of all hardware products.
2. Review and finalize construction schedule and verify availability of materials.
3. Review the required inspecting, testing, commissioning, and demonstration procedures

O. Intent of Hardware Schedule:
1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required at no cost to the Owner.

2. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to be submitted to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.5 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.6 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.

3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual overhead door closer bodies.
4. Five years for motorized electric latch retraction exit devices.
5. Two years for electromechanical door hardware.

1.7 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. 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

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

D. Contractor to provide a **turnkey access control system**, including but not limited to: card readers, POE locks, nodes, blades, portals, licensing, configuration, LTC files, etc. Contractor **to contract Transact** and include their pricing for the materials and certified integrators for

installation of their systems. Contractor to provide and install conduits, pathways, wiring, etc.to support the Transact system as part of this contract."

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

    a. Two Hinges: For doors with heights up to 60 inches.
    b. Three Hinges: For doors with heights 61 to 90 inches.
    c. Four Hinges: For doors with heights 91 to 120 inches.
    d. 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.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

    a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
    b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

    a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
    b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

    a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

    a. Hager Companies (HA).
    b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
    c. Stanley Hardware (ST).

B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

    a. Bommer Industries (BO).
    b. Hager Companies (HA).

c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

C. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should comply with ANSI/BHMA A156.14.

1. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.

2. Cascading: Provide a bi-parting or single direction telescoping system as required with a minimum 200 lb. per door capacity.

3. Bi-folding Door Hardware: Rated for door panels weighing up to 125 lb.

4. Pocket Sliding Door Hardware: Rated for doors weighing up to 200 lb.

5. Manufacturers:

a. Hager Companies (HA).
b. Johnson Hardware (JO).
c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.3 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) - EL-CEPT Series.
b. Securitron (SU) - EL-CEPT Series.
c. Von Duprin (VD) - EPT-10 Series.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

a. Hager Companies (HA) - Quick Connect.
b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - QC-C Series.
c. Stanley Hardware (ST) - WH Series.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:

a. Burns Manufacturing (BU).
b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
c. Trimco (TC).

B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

1. Manufacturers:

a. Burns Manufacturing (BU).
b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
c. Trimco (TC).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:

a. Burns Manufacturing (BU).
b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
c. Trimco (TC).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

1. Manufacturers:

    a. Match Existing, Field Verify.

C. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Match Facility Standard.

D. Interchangeable Cores: Provide small format interchangeable cores as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.

E. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

F. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).
4. Construction Control Keys (where required): Two (2).
5. Permanent Control Keys (where required): Two (2).

G. Construction Keying: Provide temporary keyed construction cores.

H. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

    a. Lund Equipment (LU).
    b. MMF Industries (MM).
    c. Telkee (TK).

2.7 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Manufacturers:

    a. Corbin Russwin Hardware (RU) - ML2000 Series.
    b. Sargent Manufacturing (SA) - 8200 Series.
    c. No Substitution.

B. Hurricane and Tornado Resistance Compliance: Mechanical locking and latching devices to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.

2.8 POWER OVER ETHERNET ACCESS CONTROL

A. IP Enabled Power-over-Ethernet (PoE) Integrated Card Reader Mortise Lock: IP enabled ANSI/BHMA A156.13 Grade 1 mortise lockset with integrated credential reader, request-to-exit, and door position signaling in one complete unit. Motor driven locking/unlocking control of the lever handle trim, 3/4" projection latchbolt, and optional 1" steel deadbolt. Lock is U.L listed and labeled for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Completely intelligent and integrated locking unit with Ethernet power and communication connection capability directly from the locking unit back to the central system host server without additional access control interfaces or components (excluding PoE Endspan and Midspan devices) via an existing or newly installed IEEE 802.3af PoE enabled network.
2. Open architecture design supports wired integration with third party access control systems applications via software development kit (SDK). Real-time software accessible alarms for forced door, unknown card and door held open, with inside lever handle (request-to-exit), battery status, tampering, and door position (open/closed status) monitoring.
3. 2,400 users and 10,000 event transaction history (audit trail). Distributed intelligence allows stand alone operation in absence of network communication allowing for system operational redundancy.

4. Provide a network and lock configuration CD tool kit for initial lock setup and programming via a USB connection.
5. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
6. Integrated reader supports the following credentials:

    a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
    b. 13.56 MHz contactless credentials: HID iClass, HID iClass SE, HID iClass Seos, SIO on MIFARE Classic, SIO on MIFARE DESFire EV1, MIFARE Classic, DESfire EV1, NFC-enabled mobile phones, Bluetooth Smart-enabled mobile phones.

7. Optional push-button keypad for PIN only usage or dual authentication requirements.
8. Communication between access control system and device is protected by AES 128 bit encryption via the SDK. Programmable for time zones, holidays, and automatic unlocking.
9. Power and communication from one Ethernet (CAT5e or higher) cable. Compliant with 802.3af Class 1 device specifications requiring 3.84 watts for Power over Ethernet.
10. Supports real-time system lockdown capabilities. Inside lever retracts latch bolt and deadbolt simultaneously.
11. High security mechanical key provides emergency override retraction of latchbolt without need for electronic activation.
12. Ethernet system framework, network cabling, mounting boxes, PoE end-span/mid-span, electrical hard wiring, grounding, and connections are required for complete system functionality. All system components are by others and are specified elsewhere.

    a. Power Requirement: PoE Class 2, maximum 7 watts.
    b. Network Cabling Requirements: Cat5e or higher meeting or exceeding ANSI/TIA/EIA-568-C. 24 AWG Plenum rated.
    c. Bonding and Grounding: Meet or exceed TIA-607-B requirements. Connect device ground cable to building electrical earth ground.
    d. Network Surface Mount Box: Meet or exceed ANSI/TIA/EIA-568-C requirements. Cat5e or higher (RJ45).

13. Manufacturers:

    a. Corbin Russwin Hardware (RU) - IN220 Series.
    b. Sargent Manufacturing (SA) – IN220 Series.
    c. No substitutions.

B. IP Enabled Power-over-Ethernet (PoE) Integrated Card Reader Exit Hardware: IP enabled, PoE ANSI/BHMA A156.3 Grade 1 rim and mortise exit device hardware with integrated credential reader, touchbar monitoring, and request-to-exit signaling in one complete unit. Motor driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or fire exit hardware for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override trim.
1. Completely intelligent and integrated locking unit with Ethernet power and communication connection capability directly from the locking unit back to the central system host server without additional access control interfaces or components (excluding PoE Endspan and Midspan devices) via an existing or newly installed IEEE 802.3af PoE enabled network.
2. Open architecture design supports wired integration with third party access control systems applications via software development kit (SDK). Real-time software accessible alarms for forced door, unknown card and door held open, with push rail (request-to-exit), battery status, tampering, and door position (open/closed status) monitoring.

3. 2,400 users and 10,000 event transaction history (audit trail). Distributed intelligence allows stand alone operation in absence of network communication allowing for system operational redundancy.
4. Provide a network and lock configuration CD tool kit for initial lock setup and programming via a USB connection.
5. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
6. Integrated reader supports the following credentials:

    a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
    b. 13.56 MHz contactless credentials: HID iClass, HID iClass SE, HID iClass Seos, SIO on MIFARE Classic, SIO on MIFARE DESFire EV1, MIFARE Classic, DESfire EV1, NFC-enabled mobile phones, Bluetooth Smart-enabled mobile phones.

7. Optional push-button keypad for PIN only usage or dual authentication requirements.
8. Communication between access control system and device is protected by AES 128 bit encryption via the SDK. Programmable for time zones, holidays, and automatic unlocking.
9. Power and communication from one Ethernet (CAT5e or higher) cable. Compliant with 802.3af Class 1 device specifications requiring 3.84 watts for Power over Ethernet.
10. Supports real-time system lockdown capabilities
11. High security mechanical key provides emergency override retraction of latchbolt without need for electronic activation.
12. Ethernet system framework, network cabling, mounting boxes, PoE end-span/mid-span, electrical hard wiring, grounding, and connections are required for complete system functionality. All system components are by others and are specified elsewhere.

    a. Power Requirement: PoE Class 2, maximum 7 watts.
    b. Network Cabling Requirements: Cat5e or higher meeting or exceeding ANSI/TIA/EIA-568-C. 24 AWG Plenum rated.
    c. Bonding and Grounding: Meet or exceed TIA-607-B requirements. Connect device ground cable to building electrical earth ground.
    d. Network Surface Mount Box: Meet or exceed ANSI/TIA/EIA-568-C requirements. Cat5e or higher (RJ45).

13. Manufacturers:

    a. Corbin Russwin Hardware (RU) – IN220 - ED5000 Series.
    b. Sargent Manufacturing (SA) – IN220 - 80 Series.
    c. No substitutions.

2.9 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.10 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Flush End Caps: Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.

6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
   b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.

9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

10. Rail Sizing: Provide exit device rails factory sized for proper door width application.

11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

12. Hurricane and Tornado Resistance Compliance: Conventional exit devices are to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:

    a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
    b. Sargent Manufacturing (SA) - 80 Series.
    c. No Substitution.

C. Security Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed rim panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be constructed of high grade, heat treated, corrosion resistant nickel steel alloy, and have a full 3/4" throw projection with slide action positive deadlocking.

1. Static Load Force Resistance: Minimum 3000 lbs certified independent tested.

2. Manufacturers:

    a. Corbin Russwin Hardware (RU) - ED4000S / ED5000S Series.
    b. No Substitution.

D. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish.

1. At openings designed for severe wind load conditions due to hurricanes or tornadoes, provide manufacturer’s certified mullion and accessories to meet applicable state and local windstorm codes.

2. Provide keyed removable feature where specified in the Hardware Sets.

3. Provide stabilizers and mounting brackets as required.

4. Provide electrical quick connection wiring options as specified in the hardware sets.

5. Manufacturers:

    a. Same as exit device manufacturer.

2.11 ELECTROMECHANICAL EXIT DEVICES

A. Electromechanical Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices subject to same compliance standards and requirements as mechanical exit devices. Electrified exit devices to be of type and design as specified below and in the hardware sets.

1. Energy Efficient Design: Provide devices which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

2. Where conventional power supplies are not sufficient, include any specific controllers required to provide the proper inrush current.

3. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.

4. Manufacturers:

   a. Corbin Russwin Hardware (RU) - ED5000 Series.
   b. Sargent Manufacturing (SA) - 80 Series.
   c. No Substitution.

2.12 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.

4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete

spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Manufacturers:

    a. Corbin Russwin Hardware (RU) - DC8000 Series.
    b. Norton Door Controls (NO) - 9500 Series.
    c. Sargent Manufacturing (SA) - 281 Series.

2.13 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

    a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

    a. Burns Manufacturing (BU).
    b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    c. Trimco (TC).

2.14 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

a. Burns Manufacturing (BU).
b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

a. Rixson Door Controls (RF).
b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
c. Sargent Manufacturing (SA).

2.15 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. 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 perimeter gasketing at all smoke labeled openings.

C. 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 UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Hurricane and Tornado Resistance Compliance: Architectural seals to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.

G. Manufacturers:

1. National Guard Products (NG).
2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
3. Reese Enterprises, Inc. (RE).

2.16 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

    a. Sargent Manufacturing (SA) - 3280 Series.
    b. Securitron (SU) - DPS Series.

2.17 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.18 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, 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. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. No installation shall occur on any steel surfaces (frames, doors) until ALL surfaces are primed and painted per Division 9 Section “Painting and Coating”. Coordinate to ensure steel doors are primed and painted prior to hanging.

B. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

C. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically 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. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

D. Integrated Wiegand access control products are required to be installed through current members of the ASSA ABLOY "Certified Integrator" (CI) program.

E. Retrofitting: Install door hardware to comply with manufacturer's published templates and 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 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

F. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

G. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Manufacturer’s Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

B. Door Hardware Supplier's Field Service:
1. Inspect door hardware items for correct installation and adjustment after complete installation of door hardware (prior to final manufacturer’s inspection) and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.
2. File written report of this inspection to Architect.

3.5 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.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. SU - Securitron
4. RO - Rockwood
5. RU - Corbin Russwin
6. SA - SARGENT
7. DE - Detex Corporation
8. BE - dormakaba Best
9. RF - Rixson

Hardware Sets

Set 1.0

END OF SECTION

SECTION 08 80 00 – GLAZING

PART 1 – GENERAL

1.1 SUMMARY

A. Types of work in this section includes:

1. Glass and glazing for Fixed Glass Units

B. Related Sections include the following:

1. Division 7 Section “Joint Sealants”
2. Division 8 Section “Hollow Metal Doors and Frames”
3. Division 8 Section “Flush Wood Doors”
4. Division 8 Section “FRP – Aluminum Hybrid Doors”
5. Division 8 Section “Aluminum Framed Entrances and Storefronts”
6. Division 8 Section “Door Hardware”
7. Division 10 Section “Toilet and Bath Accessories” for individual mirrors in restroom areas.

1.2 SUBMITTALS

A. Product data for all glass components, including sample warranty. Include performance for all exterior glazing.

B. Product test reports: based on evaluation of comprehensive tests performed by a qualified testing agency, for glazing sealants

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

C. 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.

D. 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.

1.3 QUALITY ASSURANCE

A. Exterior Glazing Design Requirements:

1. Small and Large missile impact 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, including Low E and reflective coatings, 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.

1.4 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.

1. Warranty period is 10 years after seal date permanently imprinted on unit.

B. Any leaks or defective work shall be immediately corrected by the manufacturer and Contractor, at no expense to the Owner.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Guardian Industries

B. Trulite Glass & Aluminum Solutions

C. Vitro Architectural Glass

D. Pilkington North America / NSG Group

2.2 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. Typical Insulating Glass Unit:

1. Equal to Guardian “SNR43 Gray outboard/clear inboard”

2. Performance Values (based on 1” insulated glass):

a. Visible Light Transmission %: 22

b. Solar Heat Gain Coefficient: 0.17

c. U-Value Winter Nighttime: 0.29

d. Reflectance – Visible Light Out / In: 10 / 13

2.2 FABRICATION

A. General:

1. Provide in overall sizes indicated on Drawings and as specified herein.

2. Impact glazing must be glazed with Dow 995 structural silicone (or equal) applied per manufacturer’s instructions. Provide primer if determined by preconstruction testing per Division 7 Section “Joint Sealants”.

a. Cure time of 21 days is required.

3. No exposed fasteners in the glazing stops will be acceptable.

B. GL1 (Clear Safety Glass):

1. Typical interior glass: 1/4-inch-thick clear tempered glass

2. Railings: 1/2 inch laminated glass

C. GL2 (Frosted Safety Glass):

1. 1/4-inch-thick frosted tempered glass

D. GL3 (Tinted Insulated Safety Glass – Spandrel Impact Resistant @ Storefront) 1-5/16":

1. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.

a. Ceramic Coating Color: As selected by Architect from manufacturer's full range.

2. 1/4" tempered tinted Outboard/Exterior Lite
3. 1/2" Air Space
4. 1/4" tempered Outboard/Interior Lite
5. .100 Solutia Saflex HP (PVB)
6. 1/4" tempered Color Spandrel Inboard Lite

E. GL4 (Tinted Safety Glass – Impact Resistant @ Exterior Doors) 9/16":

1. 1/4" fully tempered gray tinted Outboard Lite
2. .090 Solutia Saflex (PVB)
3. 1/4" tempered Inboard Lite

2.3 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.

2.4 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.

PART 3 – EXECUTION

3.1 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.

3.2 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. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing per Division 7 Section “Joint Sealants”.

6. Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

7. Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from glass.

8. Clean and trim excess glazing materials from glass and stops or frames promptly after installation, and eliminate stains and discolorations.

9. 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.

3.3 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.

3.4 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 87 00 – ARCHITECTURAL WINDOW FILMS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes the following:

1. Decorative window film.

B. Related Sections include the following:

1. Division 8 Section “Glazing”

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM E 903 - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.

2. ASTM E 308 - Standard Recommended Practice for Spectophotometry and Description of Color in CIE 1931 System.

1.3 SUBMITTALS

A. Manufacturer's Product Data for specified products.

B. Submit shop drawings showing layout, profiles, and product components, including dimensions, anchorage, and accessories.

C. Samples: 4 inch by 4 inch Samples of specified texture, color and/or pattern for verification.

D. Submit operation and maintenance data for installed products, including precautions against harmful cleaning materials and methods.

1.4 QUALITY ASSURANCE

A. Obtain all products in this section from a single Manufacturer with a minimum of 10 years’ experience.

B. Installer: Installation shall be performed by a trained and qualified installer, specialized and experienced in work required for this project.

1. NOTE: A list of experienced installation integrators is available at 3M.com/AMD or 3M Commercial Solutions Division at 1-888-650-3497.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Store products protected from weather, temperature, and other harmful conditions as recommended by supplier.

C. Product must remain in original plastic bag and boxes and have storage conditions as follows:

1. 40 °F – 90 °F

2. Out of direct sunlight

3. Clean dry area

4. Original container

5. Do not stack boxes over six (6) units high. Excessive weight can damage the film

6. Products are not recommended for interior applications where condensation consistently occurs.

7. Handle products in accordance with manufacturer's instructions.

8. Shelf life: 1 year

1.6 PROJECT/SITE CONDITIONS

A. Confirm appropriate substrate is suitable for mounting of glass finish components prior to start of installation.

B. Apply materials when environmental conditions are within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer’s absolute limits. Application temperature range is 60 °F – 100 °F (16 °C – 38 °C).

C. Environmental Limitations: Do not install until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 WARRANTY

A. Manufacturer's Warranty: Submit manufacturer's standard warranty document by authorized manufacturer.

B. Standard Product Warranty: Refer to the applicable 3M Technical Data Sheet for product warranty.

1.8 EXTRA MATERIALS

A. Furnish 2 percent extra material at time of installation. Deliver in protective packaging for storage and label contents appropriately.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. 3M Company – Commercial Solutions Division

B. Equal as approved

2.2 MATERIAL – GENERAL

A. General: field-applied application to material as visual opaque or decorative film.

B. Film: Polyester

C. Decorative Pattern: Printed

D. Adhesive: Acrylic, Pressure Sensitive, Permanent

E. Liner: Silicone-coated Polyester

F. Thickness (Average) (Film and Adhesive without Liner): 3.2 mils (80 microns)

G. Fire Performance: Surface burning characteristics when tested in accordance with ASTM E84: Class A

1. Flame Spread: 25 maximum.

2. Smoke Developed: 450 maximum.

2.3 DECORATIVE WINDOW FILM

A. Design based upon 3M™ FASARA™ Glass Finishes

B. FASARA – Milky Crystal Decorative / Privacy Glazing Film (characteristics based on application to 3mm thick clear glass) ASTM E 903, ASTM E 308:

1. Ultraviolet Transmittance: 0.1 percent.

2. Visible Light Transmittance: 19 percent.

3. Visible Light Reflectance - Interior: 42 percent.

4. Solar Heat Transmittance: 18 percent.

5. Solar Heat Reflectance: 31 percent.

6. Shading Coefficient at 90 Degrees (Normal Incidence): 0.40.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrate(s) for compliance. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Refer to the applicable 3M Technical Data Sheet to determine compatibility of finish to substrate.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

D. Responsibility for state of surfaces prior to installation to be pre-determined by installation specialist.

E. Proceeding with installation implies installer's acceptance of substrate and conditions.

3.2 SURFACE PREPARATION

A. Comply with all manufacturer's instructions for surface preparation.

B. Thoroughly clean substrate of substances that could impair the overlay's bond, including mold, mildew, oil, grease.

C. Re-clean surfaces with appropriate surface prep solvent and remove any haze or surface contamination.

3.3 APPLICATION

A. Refer to the applicable 3M Installation Guide for specific application instructions.

B. Application must be performed by qualified installer.

C. Do not proceed with installation until all finishing work has been completed in and around the work area.

D. Verify pattern prior to material acquisition.

E. Comply with manufacturer's installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

F. Remove the liner and wet the adhesive prior to installation.

G. Form smooth, wrinkle-free, bubble-free surface for finished installation.

H. Remove air bubbles, wrinkles, blisters and other defects. Use approved procedures to prevent the formation of air bubbles, wrinkles, blisters and other defects.

I. Residual water phenomenon may cause small water bubbles or clouding in the film that disappears as the water evaporates.

J. Refer to the applicable 3M Installation Guide for additional details.

3.4 CLEANING AND PROTECTION

A. Use cleaning methods recommended by architectural surfacing manufacturer for applicable environment.

B. Protect completed glass finish during remainder of construction period.

C. Consult with authorized installation specialist for project specifics.

END OF SECTION

SECTION 09 22 16 – NON-STRUCTURAL METAL FRAMING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior framing systems (includes but is not limited to supports for partition walls, 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 6 Section “Rough Carpentry”

2. Division 9 Section “Gypsum Board”

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 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

1.4 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

2.1 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.

2.2 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. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

C. 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.

D. 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.

E. 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.

4. Or equal

2.3 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. **22 gauge** at 16" o.c. at all locations.

3. Use 20 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.

2.4 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.

2.5 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

3.1 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.

3. 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 24 25 – PORTLAND CEMENT STUCCO SOFFITS (DIRECT APPLIED)

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Textured finish system for exterior soffit surfaces.

B. Related Sections include the following:

1. Division 7 Section “Joint Sealants”

1.2 SUBMITTALS

A. Product Data for each product specified.

B. Manufacturer's standard warranty.

C. Shop drawings: substrate joints, cracks, flashing transitions, penetrations, corners, terminations, and tie-ins with adjoining construction, interfaces with separate materials that form part of the stucco assembly.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: The textured finish system manufacturer shall be a company with at least ten years of experience in manufacturing specialty finishes and regularly engaged in the manufacture and marketing of products specified herein.

B. Installer's Qualifications: The contractor shall be qualified to perform the work specified by reason of experience. Contractor shall have at least 5 years of experience in commercial textured finish application, and shall have completed at least 3 projects of similar size and complexity.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials in their original sealed containers bearing manufacturer's name and identification of product.

B. Store products in a dry area with temperature maintained between 50 and 85 degrees F. Protect from direct sunlight. Protect from freezing. Protect from extreme heat (>90 degrees F).

C. Protect and store accessory and auxiliary products in accordance with manufacturer’s written instructions.

1.5 WARRANTY

A. Provide manufacturer’s standard limited warranty.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Provide stucco, primer and finish from single source manufacturer.

1. Sto Corp.

2. Parex

3. Dryvit

4. Or equal

2.2 MATERIALS

A. Provide entire system designed for direct application over exterior sheathing:

1. “StoQuik Gold Finish System for Soffits and Ceilings” as manufactured by Sto. Corp.

a. Provide complete system (with all coatings and accessories) for a complete installation.

B. Moisture barrier: equal to Sto “Gold Coat” system.

C. Textured Finish:

1. Equal to Sto Corp “Stolit Lotusan 1.0”: ready-mixed, fine textured coating.

D. Primer: Sto Primer – acrylic-based sanded primer, complies with SCAQMD Rule 1113 for primers.

E. Base Coat: Sto BTS Plus – one component polymer modified portland cement high build base coat.

F. Surface Reinforcement: Sto Mesh – nominal 4.5 oz/yd2 glass fiber reinforcing mesh treated for compatibility with Sto materials.

G. Vent: provide equal to Fry Reglet “5/8” Soffit Vent”; sizes as indicated on Drawings.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Inspect surfaces for:

1. Contamination—algae, chalkiness, dirt, dust, efflorescence, form oil, fungus, grease, laitance, mildew or other foreign substances.

2. Surface absorption and chalkiness.

3. Cracks—measure crack width and record location of cracks.

4. Damage and deterioration.

5. Moisture damage–-record any areas of moisture damage.

B. Report deviations from the requirements of project specifications or other conditions that might adversely affect the stucco installation. Start of work is acceptance of conditions.

3.2 SURFACE PREPARATION

A. Soffit board must be installed in conformance with the manufacturer's written installation instructions. Soffit board surface must be clean, dry, and free of surface contamination. Soffit board surface shall not have planar irregularities in excess of 1/16 inch and shall be free of voids, cracks, and other surface defects.

B. Ensure vapor retarder is installed correctly to ensure compliance with manufacturer's warranty.

3.3 INSTALLATION

A. Mixing: Mix Sto products in accordance with published literature. Refer to applicable Product Bulletins for specific information on use, handling, application, precautions, and limitations of specific products.

B. Application:

1. Install corrosion proof termination accessories with perforated flanges for keying of the base coat at junctures with penetrations such as soffit vents, electrical fixtures, and with abutting walls and columns. Install corrosion proof control joints with perforated flanges for keying of the base coat at intervals as required. Refer to Sto Guide details.

2. Install nominal 1/8 inch base coat by trowel to the soffit/ceiling board surface. Work horizontally or vertically in strips of 40 inches, and immediately embed the mesh into the wet base coat by troweling from the center to the edge of the mesh. Overlap mesh not less than 2-½ inches at mesh seams and feather at seams. Double wrap all inside and outside corners with minimum 8-inch overlap in each direction (except where corner bead is used at outside corners lap mesh over perforated flange of accessory). Avoid wrinkles in the mesh. The mesh must be fully embedded so that

no mesh color shows through the base coat when it is dry. Re-skim with additional base coat if mesh color is visible. Overlap perforated flanges of accessories with the base coat/reinforcing mesh application. Do not install base coat and mesh onto solid (unperforated) portions of accessories.

3. When the base coat application is dry apply the primer by brush or roller to the entire base coat surface.

4. When the primer application is dry apply the textured finish by trowel. Apply finish in a continuous application, and work to a wet edge. Float the finish to achieve the desired texture.

3.4 PROTECTION

A. Provide protection of installed materials from water infiltration into or behind them during and after construction.

B. Provide protection of installed materials from dust, dirt, precipitation, freezing and continuous high humidity until they are fully dry.

C. Seal penetrations through the finished surface with backer rod and sealant or other appropriate means.

END OF SECTION

SECTION 09 29 00 – GYPSUM BOARD

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Mold and Mildew Resistant Gypsum Board
2. Tile backer board
3. Wallboard finishing (joint tape-and-compound treatment)
4. Gypsum wallboard accessories including reveals
5. 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 “Non-Structural Metal Framing”
4. Division 9 Section “Tiling”
5. Division 9 Section “Painting and Coating”

1.2 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.

1.3 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

1.4 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.

1.5 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

2.1 MANUFACTURERS

A. Gypsum Board:

1. Georgia-Pacific

2. US Gypsum Company (USG)

3. CertainTeed Gypsum

4. Or equal (Products must be manufactured in North America)

2.2 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.

a. 1/2 inch thick required at some areas.

2. Provide at all interior areas unless noted otherwise for different type of material (abuse, tile backer).

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. Thickness as indicted on Drawings:

1. DensShield Tile Backer Board as manufactured by Georgia Pacific Corporation.

2. Fiberock Aqua-Tough as manufactured by USG Corporation.

3. Diamondback GlasRoc Tile Backer as manufactured by CertainTeed Corporation

4. Or equal

2.3 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/trim:

1. Material: extruded aluminum, color to be selected by Architect. **Provide manufacturers factory fabricated intersections, end caps and other accessories for a complete installation**

2. Provide "Control Joint" at all gypsum control joint locations as manufactured by Fry Reglet Corporation in locations indicated on Drawings.

3. Provide "Z-reveal - DRMZ 625-625" as manufactured by Fry Reglet Corporation (or equal) at **all** CMU to gypsum board transitions.

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. Manufacturer's standard paper tape is acceptable if all environmental conditions are met. If finishing prior to building being enclosed, (no dehumidification, etc), then glass fiber mesh tape is required:

   a. 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.

3. 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

3.1 PREPARATION

A. **Do not deliver or install** gypsum board until building is fully enclosed and wet work is complete.

B. **Prior to finishing**, permanent HVAC system shall be operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period. If permanent HVAC system is not available, then temporary air and humidity control must be established prior to any finish work.

3.2 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.

3.3 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:

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 ¼ 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 ¼ 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. 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.

2. Control Joints:

    a. Install control joints at locations indicated, or if not indicated, at spacing 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 firerated 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.

3.4 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 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: all Gypsum board surfaces, except where another finish level is indicated.

    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: all Gypsum board surfaces in Lobby and around the Reception Desk

    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. A thin skim coat of joint compound shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges.

3.5 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.

3.6 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

SECTION 09 30 00 – TILING

PART 1 – GENERAL

1.1 SUMMARY

A. Definitions - Tile includes ceramic surfacing units made from clay or other ceramic materials. The types of work of this section include:

1. Porcelain Tile
2. Ceramic Wall Tile
3. Anti-Fracture Membrane/Cleavage Membrane
4. Tile Trim and Accessories to achieve a complete installation.

B. Related Sections include the following:

1. Division 9 Section “Gypsum Board” for tile backer board
2. Division 9 Section “Resilient Tile Flooring”
3. Division 9 Section “Carpeting”

1.2 REFERENCES

A. ANSI A108 Series/A118 Series - American National Standards for Installation of Ceramic Tile.

B. ANSI A136.1 - American National Standard for Organic Adhesives for Installation of Ceramic Tile.

C. TCNA Handbook for Ceramic, Glass and Stone Tile Installation.

1.3 SUBMITTALS

A. Manufacturer's product data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. 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.

1. Physical samples of grout for product selection – paper copies will not be accepted.

C. Shop Drawings: Submit shop drawings including tile and their specific locations as indicated on the drawings. Show control joints to be moved, expansion joint locations, and other specialty areas for approval.

1.4 QUALITY ASSURANCE

A. Tile Manufacturing Standard: ANSI A137.1. Furnish tile complying with standard grade requirements unless indicated otherwise.

B. Obtain all installation products from a single source manufacturer to assure compatibility and to be in compliance with manufacturers Full System Warranty.

C. Tile Council of North America, Inc. (TCNA):

1. Handbook No. F113-18 at all on-grade concrete (in field) areas.

a. Handbook No. F125-Partial-18 at all on-grade concrete areas to relocate all control joints to the next nearest grout joint (or joints).

2. Handbook No. F113A-18 at all above ground concrete areas.

3. Handbook No. W245-18 for wall tile installed over backerboard.

a. Refer to Division 9 Section “Gypsum Board” for preparation of gypsum board.

4. Expansion joints, control joints, etc., must be located in compliance with TCNA EJ171 and filled with appropriate materials.

1.5 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.

1.6 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

2.1 TILE MATERIALS

A. General:

1. Colors, patterns, and locations of all tile types are as indicated on the Drawings. Other manufacturers' must submit samples prior to bid matching color and finish in order to be considered "equal".

2.2 SETTING MATERIALS

A. Manufacturers:

1. Custom Building Products
2. Laticrete International
3. MAPEI Americas
4. Bostik

B. Cementitious Tile Adhesives:

1. ANSI A118.4: Polymer-Enhanced Mortar: provide at all locations as required for setting tile as specified by ANSI A108.5 or A108.12, Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar, over substrates prepared accordingly.

a. For installing ALL floor and wall tile under 15" in either direction:

(1) Mapei "Ultraflex RS"

(2) Custom Building Products "FlexBond Premium Crack Prevention Thin-set Mortar".

(3) Bostik "Single Flex"

(4) Laticrete "254 Platinum"

b. For installing ALL floor and wall tile over 15" in either direction:

(1) Mapei "Ultralite Mortar"

(2) Custom Building Products "FlexBond – LFT Premium Crack Prevention Thin-set Mortar".

(3) Bostik "Large Format Floor"

(4) Laticrete "Multimax Lite"

C. Tile Grout:

1. Pre-mixed grout (all locations):

a. Mapei "Flexcolor Design"

b. Custom Building Products "Fusion Pro Single Component Grout"

c. Bostik "TruColor RapidCure Grout"

d. Laticrete "Spectralock Pro Premium Grout"

2.3 ACCESSORIES

A. Provide accessories in locations as indicated on Drawings and as specified herein

B. Expansion Joints:

1. Provide the following at **ALL** expansion joints in tile floors: Schlüter DILEX-KSN (or equal) sized for each application, type 304 stainless steel.

C. Termination Strip:

1. Finish: provide type 304 stainless steel (or aluminum if stainless not offered in application)

2. Between tile and LVT: Schlüter RENO-U (or equal), sized for each application, type 304 stainless steel.

3. Height: as required to suit application.

4. Provide other transitions where indicated on Drawings by Schlüter.

5. Include all inside and outside corners, caps, and other accessories required for a complete installation.

D. Grout Sealer: Custom Building Products "Aqua Mix Sealer's Choice Gold" (or equal). Water-based, penetrating sealer to provide maximum stain protection that does not change color or appearance of grout.

E. Elastomeric Joint Caulk:

1. Provide where indicated on the Drawings, and elsewhere as required at expansion joints, control joints, and at joints between tile and dissimilar materials.

a. Custom Building Products "Polyblend Caulk" (or equal). Color to match grout.

(1) Provide at all tile areas unless noted otherwise to receive silicone caulk below.

b. Custom Building Products "Commercial 100 % Silicone Caulk" (or equal). Conforms to ASTM C 920 for movement joints in heavy traffic areas and ASTM C 794.

F. Anti-Fracture Membrane/Cleavage Membrane (liquid applied):

1. Complying with ANSI A118.12

2. Provide under **ALL** floor tile for isolating the installation from cracking due to minor substrate movement and normal structural deflections as specified in ANSI A108.17.

3. Custom Building Products "RedGard Waterproofing and Crack Prevention Membrane – Liquid Applied Membrane" (or equal).

G. Anti-Fracture Membrane/Cleavage Membrane (sheet goods):

1. Complying with ANSI A118.12

2. Provide at all on-grade concrete areas where relocation of control joints to the next nearest grout joint (or joints) is required.

3. Custom Building Products "Crack Buster Pro Crack Prevention Mat Underlayment – Sheet Applied Peel N Stick Membrane" (or equal).

H. Self-Leveling Underlayment:

1. Provide where required to provide a flat, level surface for direct receipt of tile on interior installations (due to concrete not within tolerance).

2. Custom Building Products "LevelQuik Rapid Setting Self-Leveling Underlayment" (or equal) for fills up to 1 inch thick.

a. Provide primer and other components for a complete installation.

b. Include in Base Bid for up to 1/4 inch irregularities.

PART 3 – EXECUTION

3.1 PREPARATION

A. General:

1. All supporting surfaces shall be structurally sound, solid, stable, level, plumb, and true to a tolerance in plane of 1/4 inch in 10 feet for walls, 1/4 inch in 10 feet for floors when specified for thin-set method. When installing large format tile (one side greater than 15 inches) the tolerance is reduced to 1/8 inch in 10 feet. ANSI A108.01 Section 2.6.2

2. They shall be clean and free of dust, oil, grease paint, tar, wax, curing compound, primer, sealer, form release agent, laitance, loosely bonded topping, loose particles or any deleterious substance and debris which may prevent or reduce adhesion.

    a. Mechanically sand and scarify the substrate to completely remove all paint, loosely bonded topping, loose particles and construction debris.

    b. Broom clean, vacuum, then wet mop all areas to receive tile prior to installation.

3. Neutralize any trace of strong acid or alkali.

4. All substrates shall be dry. The moisture content shall not exceed 50 percent.

5. Turn off all forced ventilation and any radiant heating systems and protect work against drafts during installation and for a period of at least 72 hours after completion. Use indirect auxiliary heaters to maintain the temperatures in the area at the recommended workable level. Vent temporary heater to exterior to prevent damage to tile work from carbon dioxide build-up.

6. Before work commences examine the areas to be covered and report any flaw or adverse condition in writing to the architect and to the general contractor. Do not proceed with work until surfaces and conditions comply with the requirements indicated in ANSI A108 standard.

B. Concrete:

1. Concrete and Masonry surfaces must comply with ANSI A108.01 Section 3.2

2. All concrete substrates shall be at least 28 days old, completely cured and free of hydrostatic conditions, and/or moisture problems.

C. Gypsum Board Tile Backer surfaces:

1. Gypsum Board shall be installed per the guidelines of ANSI A108.01 Section 3.5 and per Division 9 Section “Gypsum Board”.

3.2 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. 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 joint widths.

4. Grout: Install in accordance with applicable ANSI standard as specified herein.

B. Tile Expansion Joints:

1. Install where required per TCNA “EJ171”, where required below, and per approved layout.

2. **Locate all structural control and/or expansion joints. All joints must be honored unless noted otherwise.**

a. Interior locations (at grade): 20’ to 25’ in each direction. Sealant as specified herein.

b. Interior locations (above grade): 8’ to 12’ in each direction

c. Install where tile work abuts restraining surfaces such as perimeter walls, curbs, columns, pipes, changes in backing materials, etc. Sealant as specified herein unless noted to receive Schlüter trim on the drawings.

d. Install directly over **expansion** joints in structural flooring. Provide Schlüter trim.

e. At construction joints (control/cold joints) in structural floors, relocation of the control joint to the next nearest grout joint (or joints) – TCNA F125 Partial is required. Sealant as specified herein.

3. Joints shall be same width as grout joint, but not less than 1/4”.

4. Set compressible back-up strip when mortar is placed or utilize removable wood strips to provide space for back-up after mortar has cured.

5. Keep movement joints cavities open and free of dirt, debris, grout, mortar, and setting materials.

6. Install color matched 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.

1. Sealer shall be applied 48-72 hours after grout application.

3.3 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.

3.4 PROTECTION

A. 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 and sealing is completed.

a. Stains and/or damage to the grout; as well as grout haze on the tile will be removed and replaced at no cost to the Owner.

2. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION

SECTION 09 65 10 – RESILIENT TILE FLOORING

PART 1 – GENERAL

1.1 SUMMARY

A. Extent of resilient flooring and accessories is shown on Drawings and in schedules. Work includes the following:

1. Luxury vinyl tile

2. Accessories including rubber base.

3. Patterns and locations of all flooring and accessories are as indicated on the Drawings. Colors shall be selected by the Architect.

1.2 SUMBITTALS

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 LVT 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.

1.3 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.

1.4 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.

1.5 WARRANTY

A. Provide manufacturer's standard finish and wear warranties for all products.

1.6 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

2.1 MANUFACTURERS

A. LVT:

1. Mannington Commercial

2. Equal as approved

B. Accessories:

1. Roppe

2. Tarkett/Johnsonite, Inc.

3. Or equal

C. 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.

2.2 MATERIALS

A. Luxury Vinyl Tile (LVT):

1. LVT, "Access Collection - Stone" as manufactured by Tarkett.

a. Size: 17.7" x 17.7"

b. Gauge Total Thickness: 0.197” (5.0 mm)

c. Wear Layer Thickness: 20 mil (0.51 mm)

d. Classification: ASTM F1700, Class III, Type B (solid vinyl floor)

2.3 ACCESSORIES

A. Resilient Base:

1. Product Description:

a. RB-1: “Pinnacle Rubber Base” wall base as manufactured by Roppe, or approved equal.

(1) Description: 1/8 inch thick standard top-set cove.

(2) Base over LVT/concrete: coved bottom

(3) Height: 6”.

(4) ASTM F 1861, Type TS, Group I (solid).

(5) Lengths: **In coils / rolls to limit joints**

B. Finish accessories:

1. Provide all accessories (wheeled traffic transitions, slim line, adaptors, reducers, edge guards, etc) for a complete, finished installation, including but not limited to the following:

a. LVT to sealed concrete

2. No raw edges of LVT is acceptable, provide finish accessories whether called out on the drawings or not.

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:

(1) LVT: provide Amtico 373 Luxury Vinyl Plank & Tile Adhesive

b. Cove Base Adhesives: provide equal to Johnsonite 960 Cove Base Adhesive (Johnsonite 946 Premium contact adhesive on non-porous surfaces).

D. Concrete Slab Primer:

1. Low-VOC non-staining type as recommended by flooring manufacturer.

E. Leveling and Patching Compounds:

1. Latex-modified, Portland cement based or blended hydraulic-cement-based formulation as recommended by flooring manufacturer for application.

2. Allow in Base Bid labor and material to ensure concrete surfaces meet 1/8" per 10'-0" tolerance.

PART 3 – EXECUTION

3.1 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. Prepare **LVT Substrates** according to ASTM F 710 including the following:

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacture. Do not use solvents.

2. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing. **Both** ASTM F1869 (calcium chloride) and ASTM F2170 (relative humidity) tests must be completed.

a. ASTM F1869 (calcium chloride test): Moisture Vapor Emission Rate (MVER) shall not exceed 8 lbs./1000 sq. ft./24 hrs.

b. ASTM F2170 (relative humidity (RH) test): Perform relative humidity test using in-situ probes, ASTM F 2170. Moisture Vapor Emission Rate (MVER) results must not exceed 90%.

c. Three test results for the first 1,000 sq. ft. are required, with 1 test result for every 5,000 sq. ft. thereafter. The Contractor may alternate every 5,000 sq. ft. between RH and Calcium Chloride test sites after the first 1,000 sq. ft. All test results must pass below the allowable limits for the product.

C. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained.

3.2 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.

3.3 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. Before installation, make sure the subfloor is dry and dust free

2. Apply adhesive per manufacturer's instructions and allow the adhesive to dry until there is no adhesive transfer when lightly touched (10-20 minutes). (High humidity and/or low temperatures increases tack time.)

a. Ensure that dust does not contaminate the adhesive.

3. Position the tile and ensure proper alignment before application of pressure. Reposition as necessary, installing tile floors according to color and pattern plans on Drawings.

4. 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.

5. 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.

6. Roll the flooring with a 100-pound roller within 1 hour after installation to complete the bonding process.

7. After rolling, protect the flooring while the adhesive cures. Early foot traffic, point, or rolling loads can cause adhesive displacement or breaking of the bond between the adhesive and the tile or substrate.

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.

3.4 CLEANING

A. Perform following operations immediately upon completion of resilient flooring:

1. “Initial Cleaning Procedures” per written instructions from the manufacturer to ensure a residue free surface:

   a. On newly installed floors, wait a minimum of 5 days before wet mop or auto scrub.

   b. Inspect floor for adhesive residue and remove with mineral spirits and a rag. Then clean same area with neutral cleaner and water prior to proceeding to next step.

   c. Dry mop floor to remove dust and grit from the floor. Monitor the soil load on the pad during dust mopping and replace with a new pad as required. Do not shake out dust mop - the shaking process will release previously captured dust back into the air, back on to the floor and other surfaces.

   d. Final Step: Single Disc/Square Orbital Machine Cleaning; apply manufacturer’s recommended cleaning solution to the floor in a small area. Scrub the floor in a north/south and east/west direction. Mop up or

wet/dry vacuum up. Inspect the floor when it is dry. If needed, adjust cleaning solution or pad and repeat until flooring is clear of soiling and scuff marks.

3.5 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 67 23 – RESINOUS FLOORING

PART 1 – GENERAL

1.2 SUMMARY

A. This section includes the following:

1. Resinous flooring system (epoxy broadcast with urethane topcoat) as shown on the drawings and in schedules.

B. Related sections include the following:

1. Division 3 Section “Cast-in-Place Concrete”

1.3 SYSTEM DESCRIPTION

A. The work shall consist of preparation of the substrate, the furnishing and application of an epoxy based multi roller applied flooring system with Micro colored decorative chips and urethane topcoat. The system shall have the color and texture as selected by the Architect with a nominal thickness of 60 mils. It shall be applied to the prepared areas strictly in accordance with the Manufacturer's recommendations.

B. Cove base to be applied where noted on plans and per manufacturers standard details unless otherwise noted.

1.4 SUBMITTALS

A. Product Data: Latest edition of Manufacturer's literature including performance data and installation procedures.

B. Manufacturer’s Safety Data Sheet (SDS) for each product being used.

C. Samples: A 3 x 3 inch square sample of the proposed system. Color, texture, and thickness shall be representative of overall appearance of finished system subject to normal tolerances.

1.5 QUALITY ASSURANCE

A. The Manufacturer shall have a minimum of 10 years experience in the production, sales, and technical support of epoxy and urethane industrial flooring and related materials.

B. The Applicator shall have experience in installation of the flooring system as confirmed by the manufacturer in all phases of surface preparation and application of the product specified.

C. A pre-installation conference shall be held between Applicator, General Contractor and the Owner to review and clarification of this specification, application procedure, quality control, inspection and acceptance criteria and production schedule.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping

1. All components of the system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the product type and batch number.

B. Storage and Protection

1. The Applicator shall be provided with a storage area for all components. The area shall be between 60 F and 90 F, dry, out of direct sunlight and in accordance with the Manufacturer's recommendations and relevant health and safety regulations.

2. Copies of Safety Data Sheets (SDS) for all components shall be kept on site for review.

1.7 PROJECT CONDITIONS

A. Site Requirements

1. Application may proceed while air, material and substrate temperatures are between 60 F and 90 F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.

2. The relative humidity in the specific location of the application shall be less than 85 % and the surface temperature shall be at least 5 F above the dew point.

3. The Applicator shall ensure that adequate ventilation is available for the work area.

4. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.

B. Conditions of new concrete to be coated with epoxy material.

1. Concrete shall be moisture cured for a minimum of 7 days and have fully cured a minimum of twenty eight days in accordance with ACI-308 prior to the application of the coating system pending moisture tests.

2. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary or desirable).

3. Sealers and curing agents should not to be used.

4. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

C. Safety Requirements

1. All open flames and spark-producing equipment shall be removed from the work area prior to commencement of application.

2. "No Smoking" signs shall be posted at the entrances to the work area.

3. Non-related personnel in the work area shall be kept to a minimum.

1.8 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of (1) full year from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (1) full year from date of installation.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Dur-A-Flex, Inc. (Basis of design – all specifications based upon)

B. Key Resin Company

C. Stonhard, Inc.

D. Neogard (A Division of Hempel (USA), Inc.)

E. Dex-O-Tex

F. Equal as approved

2.2 FLOORING

A. Dur-A-Flex, Inc, Dur-A-Chip, Epoxy-Based seamless flooring system

1. System Materials:

a. Primer: Dur-A-Flex, Inc, Dur-A-Glaze #4 WB resin and hardener.

b. First Broadcast Coat: Dur-A-Flex, Inc, Dur-A-Gard OPF resin and hardener.

(1) Chips: Dur-A-Flex, Inc. Micro Decorative Colored Chips.

c. Second Broadcast and Grout Coat: Dur-A-Flex, Inc. Dur-A-Glaze #4 resin and Water Clear hardener.

(1) Chips: Dur-A-Flex, Inc. Micro Decorative Colored Chips.

d. Grout coat: Dur-A-Flex, Inc. Dur-A-Glaze #4 resin and Water Clear hardener.

e. Topcoat: Dur-A-Flex, Inc. Armor Top resin, hardener and grit.

2. Patch Materials

a. Shallow Fill and Patching: Use Dur-A-Flex, Inc. Dur-A-Glaze #4 Cove Rez.

b. Deep Fill and Sloping Material (over ¼ inch): Use Dur-A-Flex, Inc. Dur-A-Crete.

2.3 PRODUCT REQUIREMENTS

A. Primer: Dur-A-Glaze #4 WB

1. Percent Solids: 56 %

2. VOC: 2 g/L

3. Bond Strength to Concrete ASTM D 4541: 550 psi, substrates fails

4. Hardness, ASTM D 3363: 3H

5. Elongation, ASTM D 2370: 9 %

6. Flexibility (1/4: Cylindrical mandrel), ASTM D 1737: Pass

7. Impact Resistance, MIL D-2794: >160

8. Abrasion Resistance ASTM D 4060, CS 17 wheel, 1,000 g Load: 30 mg loss

B. Broadcast Coat: Dur-A-Gard OPF

1. Percent Solids: 100 %

2. VOC: 59 g/L

3. Compressive Strength, ASTM D 695: 16,000 psi

4. Tensile Strength, ASTM D 638: 3,800 psi

5. Flexural Strength, ASTM D 790: 4,000 psi

6. Abrasion Resistance, ASTM D 4060

a. C-10 Wheel, 1,000 gm load, 1,000 cycles: 35 mg loss

7. Flame Spread/NFPA-101, ASTM E 84: Class A

8. Impact Resistance MIL D-3134: 0.025 inch Max
9. Water Absorption. MIL D-3134: Pass
10. Potlife @ 70 F: 20-25 minutes

C. Broadcast Coat and Grout Coat: Dur-A-Glaze #4 Water Clear

1. Percent Solids: 100 %
2. VOC: 3.8 g/L
3. Compressive Strength, ASTM D 695: 11,200 psi
4. Tensile Strength, ASTM D 638: 2,100 psi
5. Flexural Strength, ASTM D 790: 5,100 psi
6. Abrasion Resistance, ASTM D 4060, C-10 Wheel, 1,000 gm load, 1,000 cycles: 29 mg loss
7. Flame Spread/NFPA-101, ASTM E 84: Class A
8. Impact Resistance MIL D-24613: 0.0007 inches, no cracking or delamination
9. Water Absorption. MIL D-24613: Nil
10. Potlife @ 70 F: 20 minutes

D. Topcoat: Armor Top (Satin)

1. Percent Solids: 95 %
2. VOC: 0 g/L
3. Tensile Strength, ASTM D 2370: 7,000 psi
4. Adhesion, ASTM 4541: Substrate Failure
5. Hardness, ASTM D 3363: 4H
6. 60^0 Gloss ASTM D 523: 70
7. Abrasion Resistance, ASTM D4060, CS 17 wheel (1,000 g load) 1,000 cycles:
   a. 4 mg loss with grit
   b. 10 mg loss without grit
8. Pot Life, 70 F, 50% RH: 2 Hours
9. Full Chemical Resistance: 7 days

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.

1. Verify that substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

3.2 PREPARATION

A. General

1. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.

2. Moisture Testing: If Concrete Moisture Reduction Admixture (per Division 3 Section) is not accepted, then proceed with the following test procedures (no additional testing required if accepted):

a. Perform relative humidity test using is situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.

b. If the relative humidity exceeds 75% then Dur-A-Flex, Inc Dur-A-Glaze MVP Primer moisture mitigation system must be installed prior to resinous flooring installation. Slab-on grade substrates without a vapor barrier may also require the moisture mitigation system.

3. There shall be no visible moisture present on the surface at the time of application of the system. Compressed oil-free air and/or a light passing of a propane torch may be used to dry the substrate.

4. Mechanical surface preparation

a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 3-4 as described by the International Concrete Repair Institute.

b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and

profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.

c. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.

d. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer's recommendations.

5. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

3.3 APPLICATION

A. General

1. The system shall be applied in six distinct steps as listed below:

a. Substrate preparation

b. Priming

c. First broadcast coat application with first chip broadcast

d. Second broadcast coat with second chip broadcast

e. Grout coat application

f. Topcoat application

2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.

3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.

4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.

5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.

B. Primer

1. The primer shall be Dur-A-Glaze #4 WB Primer that is mixed at the ratio of 1 part resin to 4 parts hardener per the manufacturer's instructions.

2. The primer shall be applied by 1/8 inch notched squeegee and back rolled at the rate of 200 sf/gal to yield a dry film thickness of 4 mils.

C. Broadcast Coats

1. The broadcast coat shall be applied as a double broadcast system as specified by the Architect.

2. The broadcast coat shall be comprised of two components, a resin, and hardener as supplied by the Manufacturer and mixed in the ratio of 2 parts resin to 1 part hardener.

3. The resin shall be added to the hardener and thoroughly mixed by suitably approved mechanical means.

4. The first broadcast coat shall be applied over horizontal surfaces using the dip and roll, and back roll method at the rate of 300 sf/gal using the Dur-A-Gard OPF material.

5. Chips shall be broadcast to excess into the wet material, Micro chips at the rate of 0.15 lbs/sf.

6. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.

7. Scrape the floor with a trowel or floor scraper. Sweep and vacuum the floor again.

8. Apply a second broadcast coat of resin shall be applied by flat squeegee then back rolled with a coverage rate of 150 sf/gal with the Dur-A-Glaze #4 Water Clear epoxy.

9. Chips shall be broadcast to excess, Micro chips at the rate of 0.15 lbs/sf.

10. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose chips.

11. Scrape the floor with a trowel or floor scraper. Sweep and vacuum the floor again.

D. Grout Coat

1. The grout coat shall be comprised of a Dur-A-Glaze # 4 Water Clear epoxy that is mixed in the ratio of 1 part hardener to 2 parts resin and installed per the manufacturer’s recommendations.

2. The grout coat shall be squeegee applied and back rolled with a coverage rate of 100 sf/gal.

E. Topcoat

1. The topcoat of Armor Top shall be roller applied at the rate of 500 sf/gal to yield a dry film thickness of 3 mils.

2. The finish floor will have a nominal thickness of 60 mils.

3.4 CLEANING AND PROTECTION

A. Cure flooring material in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.

B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

END OF SECTION

SECTION 09 68 00 – CARPETING

PART 1 – GENERAL

1.1 SUMMARY

A. The extent of carpeting is indicated on the Drawings and the Specifications, and is defined to include carpet and accessories.

   1. Carpet – direct glue-down installation

B. Related Sections include the following:

   1. Division 9 Section “Tiling”

   2. Division 9 Section “Resilient Tile” for rubber base and accessories.

1.2 SUBMITTALS

A. Shop drawings showing layout of carpet, accessory type and location.

B. Written warranty as specified herein.

C. Manufacturer's descriptive data.

D. Flame Spread Test Reports or Radiant Panel Test to verify the meeting of the various requirements specified herein.

E. Samples: Submit minimum 12 inch x 12 inch samples of each carpet required

F. Product Data: Provide Safety Data Sheets for carpet adhesives.

G. Manufacturer's certificate stating that carpet furnished, identified by register numbers was manufactured according to these specifications.

1.3 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. Radiant Panel Passes Class 1, ≥ 0.45 W/cm (ASTM-E648)

E. Smoke Density < 450 Dm corr (ASTM-E662), Flaming

F. Static ≤ 3.5 kV (AATCC-134), Step

G. Carpet Identification: Provide hang tag, or other suitable method, to identify carpet delivered as to manufacturer (or supplier), and style.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver carpeting material in protective wrapping, and store inside, protected from weather, moisture and soiling.

1.5 WARRANTY

A. Provide manufacturer’s standard lifetime commercial warranty.

B. Carpeting:

1. Lifetime Limited Warranty, Including Face Wear, Moisture Barrier, Delamination, Tuft Bind, Unraveling, and Static Protection

2. Bleach Resistant Warranty: ColorSafe with 15 Year Limited Warranty Against Color Loss from Bleach Spills

3. Stain Resistant Warranty: XGUARD with 15 Year Limited Warranty Against Staining

PART 2 – PRODUCTS

2.1 MATERIALS

A. Carpet - General:

1. Approved Manufacturers for carpeting only:

a. Bentley Mills

b. Tandus Centiva

c. Mannington Commercial

d. Interface

e. Masland Contract

f. Shaw Contract

2. Color and Pattern: as indicated on the Drawings.

3. Substitutions: Subject to compliance with requirements, products of other manufacturers may be substituted upon matching Architect's control sample in yarn type, color, texture, weight, adhesive and backing construction.

B. CPT-1 AND CPT-2:

1. "Ponder – 410430" from the Meiso Collection as manufactured by Bentley Mills

2. Face Construction:

a. Construction type: tufted textured loop

b. Fiber: Bentley Premium Type 6,6 nylon

c. Dye Method: solution dyed

d. Backing and Size: Bentley "EliteFlex" Cushion; 6'-0"

e. Gauge: 1/12 inch

f. Stiches per inch: 11.4

g. Tufted weight: 64 ounces per yard

h. Total thickness: 0.255 inch

2.2 ACCESSORIES

A. General: Provide accessories as indicated on Drawings and specified herein.

1. Carpet to LVT: per Division 9 Section "Resilient Tile Flooring"

2. Carpet to Tile: per Division 9 Section "Tiling"

B. Installation Adhesive:

1. Carpet: Bentley "Healthbond 2399" Adhesive

C. Miscellaneous Materials: As recommended by manufacturers of carpet, and other carpeting products; and selected by installer to meet project circumstance and requirements.

PART 3 – EXECUTION

3.1 INSTALLERS

A. Flooring Contractor must examine substrates for moisture content and other conditions under which carpeting is to be installed, and notify Construction Manager and Architect in writing of conditions detrimental to proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

B. Verify that substrates are dry and free of curing compounds, sealers, and hardeners. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacture. 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. Do not use solvents.

C. Sequence carpeting with other work so as to minimize possibility of damage and soiling of carpet during remainder of construction period.

D. No RH or PH testing is required due to type of adhesive specified.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's instructions and recommendations; maintain uniformity of direction and lay of pile.

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.

B. Glue-down Installation:

1. Fit sections of carpet into each space prior to application of adhesive.

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.

3.3 CLEANING

A. Remove debris, sorting pieces to be saved from scraps to 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.

3.4 PROTECTION

A. Flooring 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 74 16 – FLEXIBLE WOOD VENEER WALLCOVERING

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes flexible wood wall covering and all accessories for a complete installation.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fire resistance characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate seams and termination points.

C. Samples for Verification: Full width by 36-inch long section of wall covering specified. Include product name, wood species and cut and/or figure labeled on the back of each sample

D. Maintenance Data: For wall coverings to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Composition:

1. A five-ply wood wallcovering consisting of authentic wood veneer, bonded to paper, foil, glue line barrier, and paper.

2. Factory applied protective urethane coating to ensure quality and help maintain the integrity of the wood veneer wallcovering.

B. Fire Hazard Classification: Provide materials that comply with Class A Fire Rating when tested in accordance with ASTM E84.

1. Flame Spread: 10

2. Smoke Developed: 25

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build full size, in-place mockups for each type of wall covering on each substrate required.

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

1.4 PROJECT / SITE CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

B. Maintain a constant temperature range of 65 degrees F to 85 degrees F, with not more than 50% relative humidity and not less than the relative humidity specified for the project area in the AWI Quality Standards Section 1700-T-19, for at least 4 days prior to, throughout the installation period and maintained consistently thereafter.

C. Lighting: Do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.

D. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

1.5 MAINTENANCE

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Covering Materials: For each type, full-size units equal to 5 percent of amount installed.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Arbor Wood Veneer Wallcovering (distributed by Koroseal Interior Products, LLC)

B. Momentum Textiles and Wallcovering

C. Equal as approved

2.2 MATERIALS

A. Wall Covering (WC-1)

1. Wallcovering: Arbor Wood Wallcovering, “AA” Architectural Grade, Flexible Wood Veneer Wallcovering. A five-ply *pre-finished urethane* wood wallcovering consisting of authentic wood veneer, bonded to paper, foil, glue line barrier, and paper.

a. Species: Recon Andes

b. Cut: Flat Cut

c. Matching: Book Match

d. Factory Finish: Standard

2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer.

B. Adhesive: equal to Roman Decorating Products “Extra Strength Pro-732, Clay Strippable Pro-774”

C. Substrate Primer/Sealer: Acrylic base primer specifically formulated for use with flexible wood veneer wallcovering. No Oil Based Primers is to be used

1. Equal to Romans Decorating Products “Pro-935 (R 35), Pro-977”

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.

1. Ensure that all surfaces are true, smooth, level finish, free from cracks, dirt, dust, irregularities or rough spots. Walls are to be thoroughly dry before application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.

2. Painted Surfaces: Treat areas susceptible to pigment bleeding.

D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.

E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 96 hours before installation.

3.3 INSTALLATION

A. General: Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.

1. Follow joint layout as indicated on Drawings.

B. Install each sheet in sequential, numerical order, as printed on the back of each sheet.

C. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.

D. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

E. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

3.4 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

SECTION 09 80 13 – ACOUSTICAL TREATMENT

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes the following in locations where indicated on Drawings:

1. Acoustical wall panels

1.2 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.

1.3 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.

1.4 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.

1.5 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.

1.6 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.

1.7 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

2.1 MANUFACTURERS

A. Golterman & Sabo

B. Armstrong World Industries (Soundsoak)

C. Acoustical Resources, Inc. (200B)

2.2 ACOUSTICAL WALL PANELS

A. Wrapped Fiberglass Panels: "Acousti-Panels AP", as manufactured by Golterman & Sabo.

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: 2 inch; NRC 1.05.

3. Size: As indicated on drawings.

4. Finish Material:

a. Fabric and Color: provide as indicated on Finish Schedule on Drawings.

5. Corners: Square.

6. Mounting: Adhesive.

2.3 ACCESSORIES

A. Mounting Adhesive: Water-based, heavy-bodied adhesive (low or no VOC) as recommended by manufacturer of acoustical panels.

PART3 – EXECUTION

3.1 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.

3.2 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.

3.3 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.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 09 90 00 – PAINTING AND COATING

PART 1 – GENERAL

1.1 SUMMARY

A. Extent of painting work is shown on drawings and schedules, and as herein specified.

B. Related Sections include the following:

1. Division 9 Section “Gypsum Board”

C. 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.

D. "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.

E. 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.

1.2 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.

1.3 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.

1.4 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.

1.5 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

2.1 MANUFACTURERS

A. Paint Acceptable Manufacturers:

1. Sherwin-Williams Company (Basis of Design)
2. Benjamin Moore
3. PPG Paints

B. Unless otherwise specified for an individual product or material, supply all products specified in this section from the same manufacturer.

2.2 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.

2.3 MATERIALS

A. General: tint intermediate coat lighter than finish coat.

B. Typical Interior Latex Flat, Eg-Shel, Semi-Gloss, and Primer (provide unless indicated otherwise):

1. Interior latex. Provide one of the following:

a. Sherwin-Williams Company: ProMar200 Interior Latex Enamel

b. Benjamin Moore: Natura Zero-VOC

c. PPG Paints: Pure Performance

2. Coverage:

    a. 1st Coat: equal to Sherwin Williams ProMar 200 zero-VOC Interior Latex Primer, B28W02600 Series (4.0 mils wet – 1.0 mil dry)

    b. 2nd Coat: equal to Sherwin Williams ProMar 200 Interior Latex Eg-Shel Enamel, B20W02253 Series (4 mils wet, 1.6 mils dry)

    c. 3rd Coat: equal to Sherwin Williams ProMar 200 Interior Latex Eg-Shel Enamel, B20W02253 Series (4 mils wet, 1.6 mils dry)

3. 1 coat primer, 1 coat intermediate, and 1 topcoat finish required for <u>all surfaces</u>.

C. Interior Woodwork paint system:

1. Semi-Gloss Finish:

    a. 1st Coat: equal to Sherwin Williams Premium Wall & Wood Primer, B28W08111 Series (4.0 mils wet – 1.6 mils dry)

    b. 2nd Coat: equal to Sherwin Williams ProMar 200 Interior Alkyd Semi-Gloss, B34W00207 Series (4 mils wet, 1.7 mils dry)

    c. 3rd Coat: equal to Sherwin Williams ProMar 200 Interior Alkyd Semi-Gloss, B34W00207 Series (4 mils wet, 1.7 mils dry)

D. *<u>Interior</u>* Metal paint system:

1. Semi-Gloss Finish:

    a. 1st Coat: equal to Sherwin Williams Pro Industrial Pro-Cryl® Universal Primer, B66-310 Series (5.0 –10.0 mil dry)

    b. 2nd Coat: equal to Sherwin Williams ProMar 200 Interior Alkyd Semi-Gloss, B34W00207 Series (4 mils wet, 1.7 mils dry)

    c. 3rd Coat: equal to Sherwin Williams ProMar 200 Interior Alkyd Semi-Gloss, B34W00207 Series (4 mils wet, 1.7 mils dry)

E. Interior CMU paint system:

1. Eg-Shel Finish:

    a. 1st Coat: equal to Sherwin Williams PrepRite Interior/Exterior Latex Block Filler White, B25W25 Series (16 mils wet, 7.7 mils dry)

    b. 2nd Coat: equal to Sherwin Williams Pro Industrial PreCatalyzed Waterbased Epoxy Eg-Shel K45150 (4.0 mils wet; 1.5 mils dry)

    c. 3rd Coat: equal to Sherwin Williams Pro Industrial PreCatalyzed Waterbased Epoxy Eg-Shel K45150 (4.0 mils wet; 1.5 mils dry)

F. *Exterior* Metal paint system **(provide at all exterior metal)**:

1. Gloss Finish:

a. 1st Coat: Sherwin Williams Pro Industrial Pro-Cryl® Universal Primer, B66-310 Series (5.0 – 10.0-mil dry)

b. 2nd Coat: Sherwin Williams All Surface Enamel Exterior Alkyd, A11 Series (4.0 mils wet – 1.7 mils dry)

c. 3rd Coat: Sherwin Williams All Surface Enamel Exterior Alkyd, A11 Series (4.0 mils wet – 1.7 mils dry)

G. Interior stain (existing glulam beams): provide per Division 6 Section “Interior Finish Carpentry”

H. 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

3.1 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.

3.2 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. Masonry surfaces must be dry before priming. Moisture content must be 15% or lower, and the pH between 6 and 9.

F. For specific substrate preparation, see “Surface Preparation” at end of Section.

G. Maximize ventilation during application and drying.

H. Isolate area of application from rest of building.

3.3 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, fire sprinkler piping, 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.

3.4 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.

3.5 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.

3.6 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.

3.7 SCHEDULE

A. If paint on walls is to be applied using spray technique, the final coat shall be backrolled to ensure even distribution.

B. Paint all exposed ductwork and electrical conduit where exposed ceilings occur (use a flat finish in lieu of scheduled paint).

C. At all gypsum board ceilings, use a flat finish in lieu of scheduled paint.

D. **Paint all exterior metal** – primed and/or galvanized (doors/frames, conduit, etc) unless otherwise noted on Drawings.

E. Paint / stain all millwork not to receive surfacing as indicated on Drawings. Coordinate with Division 6 Section “Finish Carpentry” and “Interior Architectural Woodwork”.

F. Paint all hollow metal frames and doors prior to application of any hardware. Coordinate to ensure that doors arrive on-site prior to hardware being installed to ensure painting is done prior to hanging.

END OF SECTION

SECTION 10 14 00 – SIGNAGE

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following identifying devices:

1. Room identification
2. Toilet identification
3. Stair identification
4. Exterior signage
5. Building plaque
6. Aluminum letters

1.2 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.

1. Installer to submit CAD generated location plan noting the location of all signage and cross referenced to message schedule for architect's approval.

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.

1.3 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.

1.4 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.

1.5 WARRANTY

A. Provide manufacturer’s warranty against defects in materials or workmanship for minimum 5 years.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Mohawk Sign Systems, Inc.

B. Gemini Incorporated

C. Innerface Sign Systems, Inc.

2.2 GRAPHIC PROCESS

A. All signs shall be equal to Mohawk Sign Systems, Graphic Process Series 200A – Sand Carved using Format D.

1. Tactile characters shall be raised the required 1/32" inches from sign face. Glue-on letters or etched backgrounds are not acceptable.

2. All text shall be accompanied by Grade 2 braille. Braille shall be separated 1/2" from the corresponding raised characters or symbols. Grade 2 braille translation to be provided by signage manufacturer.

3. Square corners, no border.

4. All letters, numbers and/or symbols shall contrast with their background, either light characters on a dark background or dark characters on a light background. Characters and background shall have a non-glare finish.

B. Plaque material shall be melamine plastic laminate, approximately 1/8" thick with contrasting core color. The melamine shall be non-static, fire-retardant and self-extinguishing. The plastic laminate will be impervious to most acids, alkalies, alcohol, solvents, abrasives and boiling water.

C. Letterform shall be Gill Sans upper case.

D. Size of letters and numbers shall be as follows:

1. Room numbers shall be 5/8"

2. Lettering for room ID signs shall be 5/8".

3. Symbol size shall be 4".

4. Standard Grade 2 braille shall be 1/2" below copy.

2.3 ROOM IDENTIFICATION SIGNS

A. Type A – Dormitory room entrance with room number and Braille:

1. Design equal to Mohawk Sign Systems M201-4 Room Number

2. Size: 2" wide x 4" high.

B. Type B – Community bathroom entrance with room number and Braille (not required on bathrooms located within dorm rooms):

1. Design equal to Mohawk Sign Systems 200A Restroom Sign (with Symbol MS-5)

2. Size: 6" wide x 8" high.

C. Type C – Miscellaneous interior signage (laundry, electrical, mechanical, etc – all other rooms not under a different sign type):

1. Design equal to Mohawk Sign Systems 200A Room Name and Number

2. Size: 6" wide x 6" high.

D. Type D – Stair Identification:

1. Design equal to Mohawk Sign Systems 200A Room Name and Stair Symbol (MS9).

2. Size: 6" wide x 8" high.

3. Provide at each stairwell door, corridor side.

E. Exterior door signage:

1. Design equal to Mohawk Sign Systems M-203-9 w/ black aluminum frame and raised accent line (sign to have text and braille)

a. Frame to be manufactured from a continuous piece of extruded aluminum angle 1/16" thick by 1/2" deep. The frame has square corners and a 1/8" back up plate. The insert is separated from the frame with a 3/32" reveal.

2. Size: 9" wide x 9" high.

3. Design: MGCCC logo at bottom, text at top (to be determined during submittal phase), with raised accent line between.

4. **Quantity:** provide 1 at each exterior door opening at lobby spaces.

2.4 BUILDING PLAQUE

A. Provide the following Aluminum Plaque with custom etched emblem (State of Mississippi Seal

1. Size: 24” wide x 36” high
2. Thickness: 3/4”
3. Copy: Raised copy – Horizontal Stroke
4. Typeset: times new roman
5. Finish: Pebble w/ Satin Surface
6. Edge style: inset single line
7. Background finish: 2025 black painted
8. Clear Coat: satin
9. Mount: Blind Mount – Standard Studs
10. Seal Logo: Raised with recessed detail
11. All other text: raised brushed

2.5 ALUMINUM LETTERS

A. Equal to cast aluminum letters as manufactured by Gemini Incorporated.

B. Size and style: 10” cast alum letters; letter style - Times New Roman; Color - Metallic Gold 2756.

C. Provide letters below in layout as indicated on Drawings:

1. “MELLINGER HALL” (x2).

PART 3 – EXECUTION

3.1 EXAMINATION

A. Installer shall examine signs for defects, damage and compliance with specifications. Installation shall not proceed until unsatisfactory conditions are corrected.

3.2 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 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.

4. Signs shall be level, plumb, and at heights indicated with sign surfaces free from defects.

5. 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 masonry.

3.3 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 28 00 – TOILET AND BATH ACCESSORIES

PART 1 – GENERAL

1.1 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 metal stud walls for all items specified.

B. Related Sections include the following:

1. Division 6 Section “Rough Carpentry” for blocking in metal stud walls.

2. Division 22 Sections

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's data sheets for each product specified, including the following:

1. Installation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Cleaning and maintenance instructions.

4. Replacement parts information.

B. Shop Drawings: Provide shop drawings showing locations, mounting heights, clearances, etc. for each accessory.

C. Schedule: Submit a complete toilet accessory schedule, indicating the type and quantity to be installed in each washroom. Use room numbers as indicated on the Drawings.

D. Setting Drawings: Where cutouts are required in other work, provide templates, substrate preparation instructions, and directions for preparing cutouts and for installation of anchorage devices.

1.3 QUALITY ASSURANCE

A. Manufacturer: Provide products manufactured by a company with a minimum of 10 years successful experience manufacturing similar products.

B. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.

C. 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.

D. Accessory Locations: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units.

E. 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.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations. Protect from damage.

1.5 WARRANTY

A. Manufacturer's Warranty for Washroom Accessories: Manufacturer's standard 1 year warranty for materials and workmanship.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Bobrick Washroom Equipment (Basis of Design)

B. American Specialties Inc. (ASI)

C. Bradley Corporation

2.2 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.

2.3 GRAB BARS

A. Compliance: Universal/accessibility design, including ADA-ABA and ICC/ANSI for structural strength.

1. Capacity: Designed to support 900 lbs in compliant installations.

B. Description: Grab bar with 90 degree return to flange. Clearance between grab bar and finished wall is 1-1/2 inches.

C. Grab Bar Materials: 18-8, Type 304, 18 gauge stainless steel tubing with satin finish, ends of grab bar pass through flanges and are heliarc welded to flanges to form one structural unit, outside diameter 1-1/2 inches.

D. Mounting Flanges: Concealed, 18-8, Type 304, 1/8 inch thick, stainless steel plate.

1. End Flanges: 2 inches x 3-1/8 inches with two holes for attachment to wall.

2. Intermediate Flanges: 2-5/8 inches x 3-1/8 inches wide x 3-1/8 inch diameter.

E. Snap Flange Covers: 18-8, Type 304, 22 gauge drawn stainless steel with satin finish, 3-1/4 inch diameter x 1/2 inches deep; snap over mounting flange to conceal mounting screws.

F. Mounting Accessories: Provide mounting accessories as required for complete installation.

G. Manufacturer / Model No.:

1. 36” Grab Bar: equal to Bobrick, No. B-6806 x 36

2. 42” Grab Bar: equal to Bobrick, No. B-6806 x 42

3. 18” Vertical Grab Bar: equal to Bobrick, No. B-6806 x 18

2.4 TOWEL HOOKS

A. Stainless Steel Clothes Hooks:

1. Materials: All-welded 18-8, Type 304, 11 gauge stainless steel with satin finish.

2. Projection from Wall: 1-1/8 inch.

B. Manufacturer / Model No.:

1. equal to Bobrick No. B-233

2.5 ROBE HOOKS

A. Flange & Support Arm — 18-8, type-304, 22-gauge stainless steel. Concealed, 18-gauge stainless steel mounting bracket. All-welded construction. Secured to wall plate with a stainless steel setscrew.

B. Concealed Wall Plate — 18-8, type-304, 19-gauge stainless steel.

C. Cap — 18-8, type-304, 14-gauge stainless steel. Welded to the support arm.

D. Manufacturer / Model No.:

1. Surface Mounted Double Robe Hook: Bobrick B-76727

2.6 TOWEL BAR

A. Towel Bar — 18-8, type-304, 18-gauge stainless steel tubing with satin finish. 1" outside diameter. Ends are welded to flanges. Clearance between the towel bar and wall is 1-1/2”.

B. Concealed Mounting Flanges — 18-8, type-304, 11-gauge thick, stainless steel plate. 2" x 3-1/8" with holes for attachment to wall.

C. Snap Flange Covers — 18-8, type-304, 22-gauge drawn stainless steel with bright polish finish. 3-1/4" diameter x 5/8" deep. Each cover snaps over mounting flange to conceal mounting screws

D. Manufacturer / Model No.:

1. Towel Bar: Bobrick B-530 x 24

2.7 MIRROR UNITS

A. Angle Frame:

1. Materials: Type 304 stainless steel angle 3/4 inch x 3/4 inch, with satin finish with vertical grain on exposed surfaces.

2. Construction: One-piece, roll-formed construction with continuous integral stiffener.

3. Design: Beveled design on front of angle to hold mirror tightly against frame;

prevents exposure to sharp edges.

4. Corners: Heliarc welded, ground, and polished smooth.

B. Mirror:

1. No. 1 quality, 1/4 inch float/plate glass.

2. Edges: Protected with plastic filler strips.

3. Back of Mirror: Protected by full-size, shock-absorbing, water-resistant, non-abrasive 3/16 inch thick polyethylene padding.

C. Mounting: Removable, galvanized steel back with integral horizontal hanging brackets located at top and bottom for mounting on Concealed one-piece rectangular wall hanger(s); galvanized steel back fastened to frame with Concealed screws to permit glass replacement; attachment by rivets or tabs is not acceptable; Concealed Phillips head locking setscrews secure mirror to wall hanger in bottom of frame.

D. Manufacturer / Model No.:

1. 18 inch wide x 36 inch high: equal to Bobrick No. B-290 1836

2.8 SHOWER ROD

A. Curtain Rod: 18-8, Type 304, 18 gauge stainless steel tubing with satin finish.

1. Outside Diameter: 1-1/4 inches

2. Flanges: One-piece, die-formed, 18-8, Type 304, 20 gauge stainless steel with satin finish.

B. Location: provide at **each** shower/bath location.

C. Manufacturer / Model No.:

1. Curtain Rod: equal to Bobrick, No. B-6047, lengths as required

PART 3 – EXECUTION

3.1 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.

1. Verify blocking has been installed properly.

2. Verify location does not interfere with door swings or use of fixtures.

3. Comply with manufacturer's recommendations for backing and proper support.

B. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.2 INSTALLATION

A. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:

1. Use fasteners and anchors suitable for substrate and project conditions.

2. Install units rigid, straight, plumb, and level, in accordance with manufacturer's installation instructions and approved shop drawings.

3. Conceal evidence of drilling, cutting, and fitting to room finish.

4. Test for proper operation.

3.3 ADJUSTING

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly.

3.4 CLEANING

A. Clean and polish all exposed surfaces of compartments, hardware, and fittings after removing protective coatings.

B. Touch-up, repair or replace damaged products until Substantial Completion.

END OF SECTION

SECTION 10 73 40 – FABRIC SHADE CANOPIES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes shade structures, single post, double shades with surface mount anchor bolts and plates.

1.2 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. Fabrication and Installation recommendations.
4. Maintenance recommendations.

B. Shop Drawings:

1. Submit complete erection drawings showing attachment system, transverse cross sections, fabric details and seams, and other installation details to clearly indicate proper assembly of components. Include details of concrete footings, and concrete mix design.
    a. Detailed shop drawings shall be submitted, sealed by an Engineer in the State of Mississippi stating that the framing design will resist loading requirements as specified herein.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic cleaning and maintenance.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for fabrication.

1.4 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.5 WARRANTY

A. Provide with the manufacturer's 10-year limited warranty on fabrics from the date of installation against failure from significant fading, deterioration, breakdown, mildew, outdoor heat, cold, or discoloration.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. WillyGoat Toys and Playgrounds

B. Superior Recreational Products

C. Shade Systems, Inc.

D. Equal as approved

2.2 MATERIALS

A. Steel reinforcement: All Reinforcement conforms to 60,000 psi ASTM A-42 Grade 60.

B. Structural Steel:
   1. All steel tubing is triple coated for rust protection using the in-line zinc electroplating, Allied Flo-Coat process. Tubing is internally coated with zinc and organic coatings to prevent corrosion. All structural steel plates are rust/corrosion treated by zinc electroplating. Steel tubing and plates are finished with a minimum of 2.5 ~ 3.5 mil-thick UV-inhibited weather resistant powder coat. Where size of structure or determined loads require larger structural steel members or steel greater than 7 gauge thickness, carbon steel may be substituted. Cleaning and coating of carbon steel conforms to the following:
      a. A de-greasing agent is applied to remove surface oil and grease.
      b. An acid-phosphate wash be applied to etch and prepare the surface for powder-coating, where wall thickness requires pre-heating.
      c. Steel members are to be pre-heated prior to powder coat application to assure adhesion.
   2. All carbon Structural Steel shall be ASTM A-36, except steel pipe columns, which shall be ASTM A-53, grade B, unless otherwise noted. Slip fittings are manufactured using drawn-over-mandrel steel with a minimum yield strength of 70 ksi and a minimum tensile strength of 80 ksi.
   3. Steel telescoped sleeves do not have more than 1/16" tolerance, with no less than 4" overlap at all sleeves. All internal fittings are welded on one side.
   4. Structural steel is detail, fabricated, and erected in accordance with AISC specifications.
   5. All shop and field welding is executed by certified welders in accordance with the latest edition of the American Welding Society specifications.
   6. Shop connections are welded unless noted otherwise. Field connections are separately indicated on all drawings.
   7. All welds are performed using E70 electrodes or gas-metal arc welding using

ER 7053 wire. All fillet welds are a minimum 3/16" unless otherwise noted. All steel shall be welded shut at terminations to prevent internal leakage.

C. Fabric: Rachel-knitted (with a lockstitch in two directions) for strength, the panels are sewn together using a GORE TENARA expanded PTFE thread, giving the fabric its strength and long-term durability.

D. Hardware:
   1. Mounting hardware: Surface mount anchor bolts and plates.
   2. All structural field connections of the structure shall be designed and made with high-strength bolted connections using ASTM A-354, Grade B or SAE J249, Grade 8
   3. All stainless steel bolts shall comply with ASTM F-593, Alloy Group 1 or 2. All bolt fittings shall include rubber washers for water-tight seals at joints. All nuts shall comply with ASTM F-594, Alloy Group 1 or 2.
   4. Wire rope is ¼" nominal diameter, 7 strand, 19 wires per strand (minimum), with a minimum nominal tensile strength of 9,000 pounds. Wire rope shall be secured with approved fittings and cable hardware, as per manufacturers' specifications.

2.3 MANUFACTURED UNITS

A. Provide custom fabric and metal structure equal to “Solana Cantilever Single Post Shade Structure” as manufactured/distributed by WillyGoat Toys and Playgrounds.

   1. Type: Single post, double shade (locations indicated on Drawings)
   2. Size of canopy fabric: 16’-0” x 16’-0”
   3. Colors: as selected by Architect from manufacturers full line of colors.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 12 21 13 – HORIZONTAL LOUVER BLINDS

PART 1 – GENERAL

1.1 SUMMARY

A. The extent of blinds is indicated on the Drawings. The types of blinds included in this Section are:

1. Horizontal louver blinds with aluminum slats.

1.2 SUBMITTTALS

A. Product Data: For each type of product indicated.

B. Samples: actual metal colors of blind components for selection.

1.3 QUALITY ASSURANCE

A. Field Measurements: Take field measurements prior to fabrication to ensure proper fitting of work.

B. Fire-Test-Response Characteristics: Provide horizontal louver blinds with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Flame-Resistance Ratings: Passes NFPA 701.

C. 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.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Springs Window Fashions Division, Inc. (Bali)

B. Hunter Douglas

C. Levolor, a Newell Rubbermaid Company

D. Or equal

2.2 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS

A. Product: Springs Window Fashions (SWF Contract) “S3000” Cordless Horizontal Aluminum Blinds or equal.

1. Headrail shall be 1-1/2" high x 2-1/8" wide x .050" thick aluminum valance-free design with a curved front profile, rolled edges at the top and a light- blocking lip at the lower back side. The finishing process includes phosphate treatment for corrosion resistance, a chrome-free sealer, a low HAP urethane primer, and a topcoat with low HAP polyester baked enamel.

2. Cordless lift mechanism shall consist of polymer gears and spools that are driven by a variable force coil spring encased in durable high impact nylon housing. The variable force coil spring counter balances the weight of the bottomrail and slats, holding the slats at the desired height as the bottomrail is raised and lowered. Spools inside the patented mechanism store the lift cord as the blind is operated eliminating exposed lift cords.

3. Tilter shall be made of injection-molded thermoplastics for smooth, low-friction operation and will incorporate a clutch mechanism to prevent damage due to over tilting.

4. Braided ladder shall be made of 100% high tenacity polyester incorporating two extra strength rungs per ladder to support slats. Standard ladder spacing shall be 18.0mm.

5. Slats shall be 5000 series cold-rolled aluminum containing the maximum allowable recycled content to produce a high strength and corrosion resistant flexible product. Slats shall be nominally 1" wide x .006" thick and processed with Advanced Finishing Technology (AFT), providing a smooth, hard, less porous surface. AFT delivers anti-static performance to repel dust and antimicrobial qualities to resist fungal and bacterial growth. Slats shall be treated with a chrome-free sealer and a topcoat of low HAP polyester baked enamel.

6. Bottomrail shall be completely enclosed tubular shape made of phosphate treated steel, finished with a polyester baked enamel paint finish and shall measure .025" thick.

B. Options shall include:

1. Hidden Holes™ privacy slat with 18mm spacing

2. Hold down brackets

PART 3 – EXECUTION

3.1 INSPECTION

A. Inspect jobsite, including mounting surfaces, verification of field measurements, and installation conditions. Notify any ambiguities to the Contractor. Start of installation is acceptance of conditions.

3.2 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions including recommended support brackets and fasteners.

B. Install blinds with adequate clearance to permit smooth operation of the blinds. Demonstrate blinds to be in smooth, uniform working order.

3.3 CLEANING

A. Clean blinds with mild soap and water only. Do not use cleaning methods involving heat, bleach, abrasives, or solvents. Do not use window cloths with paper content. Use of these methods will void the warranty.

END OF SECTION

SECTION 12 24 13 – CLUTCH OPERATED MANUAL WINDOW SHADES

PART 1 GENERAL

1.1 SUMMARY

A. Manually operated, roll-up fabric interior window shades including mounting and operating hardware.

1. Light filtering fabric required.

1.2 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product specified, including:

1. Preparation instructions and recommendations.

2. Installation and maintenance instructions.

3. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.

4. Storage and handling requirements and recommendations.

5. Mounting details and installation methods.

B. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.

C. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings, field verified window dimensions, quantities, type of shade, controls, fabric, and color, and include opening sizes and key to typical mounting details.

D. Selection Samples: For each finish product specified, two complete sets of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.

E. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.

B. NFPA Flame-Test: Passes NFPA 701. Materials tested shall be identical to products proposed for use.

C. Mock-Up: Provide a mock-up of one of roller shade assembly specified for evaluation of mounting, appearance and accessories.

1. Locate mock-up in window(s) designated by Architect.

2. Do not proceed with remaining work until mock-up is accepted by Architect.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver window shades until building is enclosed and construction within spaces where shades will be installed is substantially complete.

B. Deliver products in manufacturer's original, unopened, undamaged containers with labels intact.

C. Label containers and shades according to Window Shade Schedule.

D. Store products in manufacturer's unopened packaging until ready for installation.

1.5 SEQUENCING

A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.6 PROJECT CONDITIONS

A. Install roller shades after finish work and ambient temperature, humidity and ventilation conditions are maintained at levels recommended for project upon completion.

1.7 WARRANTY

A. Hardware and Shade Fabric: manufacturer’s standard twenty-five year limited warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Draper, Inc.

B. Lutron Electronics Co.

C. Nysan Shading Systems (Hunter Douglas)

D. Or equal

2.2 MANUALLY OPERATED WINDOW SHADES

A. Provide equal to “Clutch Operated FlexShade” as manufactured by Draper, Inc.

1. Manually Operated Window Shades with Independent Control: Manually operated, vertical roll-up, fabric window shade with components necessary for complete installation.

2. Operation: Bead chain and clutch operating mechanism allowing shade to stop when chain is released. Designed never to need adjustment or lubrication. Provide limit stops to prevent shade from being raised or lowered too far.
   a. Clutch mechanism: Fabricated from high carbon steel and molded fiberglass reinforced polyester or injected molded nylon. Minimum 20 lb. lifting capacity. White or Black color as selected by Architect.

   b. Bead chain loop: Stainless steel bead chain hanging at side of window.

   c. Idler Assembly: Provide roller idler assembly of molded nylon with adjustable or spring-loaded length idler pin to facilitate easy installation, and removal of shade for service.

   d. Bead Chain Hold Down: P-Clip (standard).

3. Single Roller Configuration:

   a. Mounting:

      1) Ceiling/Wall Style Headbox.

   b. Headbox Ceiling/Wall style: Aluminum fabrication with removable closure, endcaps, and back and top cover piece:

      1) Finish: Clear anodized.

4. Roller Tube: Fabricated from extruded aluminum, galvanized steel, or enameled steel. Diameter, wall thickness, and material selected by manufacturer to accommodate shade type and size. Minimum roller diameter 1.5 inches. Fabric connected to the roller tube with LSE (low surface energy)

double sided adhesive specifically developed to attach coated textiles to metal. Adhesive attachment to eliminate horizontal impressions in fabric.

5. Shade slat:

a. Closed pocket elliptical slat: 1 inch (25 mm) aluminum elliptical slat inside of a 1-5/8 inch (41 mm) pocket with heat sealed ends.

2.3 FABRIC

A. Light-Filtering Fabrics

1. M Screen by Mermet: PVC coated fiberglass in 1 by 2 weave. GREENGUARD Gold. Manufacturer to supply GREENGUARD Gold certificate. Fire rating: NFPA 701, both small- and large-scale tests/California U.S. Title 19. Okotex-labeled.

a. 5 percent openness 11.9 oz/sq yd, .022 inches thick.

PART 3 EXECUTION

3.1 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.

3.2 PREPARATION

A. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install roller shades level, plumb, square, and true. Allow proper clearances for window operation hardware.

C. Position shades level, plumb, and at proper height relative to adjacent construction. Secure with fasteners recommended by manufacturer.

3.4 TESTING AND DEMONSTRATION

A. Test window shades to verify that operating mechanism and other operating components are functional. Correct deficiencies.

B. Demonstrate operation of shades to Owner's designated representatives.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 22 00 00 PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Section 23 01 00 – Mechanical General Requirements and Section 22 05 00 – Basic Materials and Methods, with modifications and additions specified herein, apply to the work specified in this Section.

1.2 SECTION INCLUDES:

A. Soil, Waste, Drain, and Vent Systems.

B. Domestic Water Piping System.

C. Plumbing Fixtures, Specialties, and Equipment

1.3 SUBMITTALS:

A. Submit product data and shop drawings under provisions of Section 23 01 00.

B. Include component sizes, rough-in requirements, service sizes, trim, and finishes.

C. Include certificate of compliance of pipe, fittings, and valves.

1.4 QUALITY ASSURANCE:

A. Welders' Certification: In conformance with AWS D1.1.

B. For each product, provide components by same manufacturer throughout

PART 2 – PRODUCTS

2.1 SOIL, WASTE, DRAIN, AND VENT PIPING:

A. Underground Soil, Waste, Drain and Vent Piping:

1. Polyvinyl Chloride (PVC) pipe and fittings shall be manufactured from PVC compound with a cell class of 12454 per ASTM D-1784 and conform with National Sanitation Foundation (NSF) standard 14. Pipe shall be iron pipe size (IPS) conforming to ASTM D-1785 and ASTM D-2665. Fittings shall conform to ASTM D-2665. All pipe and fittings to be produced by a single manufacturer and to be installed in accordance with manufacturer's recommendations and local code requirements. Solvent cements shall conform to ASTM D-2564; primer shall conform to ASTM F-656.

B. Above Ground Soil, Waste, Drain and Vent Piping:

1. Polyvinyl Chloride (PVC) pipe and fittings shall be manufactured from PVC compound with a cell class of 12454 per ASTM D-1784 and conform with National Sanitation Foundation (NSF) standard 14. Pipe shall be iron pipe size (IPS) conforming to ASTM D-1785 and ASTM D-2665. Fittings shall conform to ASTM D-2665. All pipe and fittings to be produced by a single manufacturer and to be installed in accordance with

manufacturer’s recommendations and local code requirements. Solvent cements shall conform to ASTM D-2564; primer shall conform to ASTM F-656.

C. Cleanouts and Test Tees: Floor cleanouts shall be Smith 4031 series, Josam Series 58000, Zurn Z1425-3, or approved equal. Wall cleanouts shall be Smith 4710, Josam Series 58000, Zurn Z1440-1, or approved equal. Exterior Cleanouts shall be Smith 4231 series, Josam Series 56040, Zurn Z1420-27, or approved equal. Set in 15" x 15" x 6" concrete pad.

2.2 INTERIOR DOMESTIC WATER PIPING:

A. Materials:

1. Copper tubing, hard-drawn, Type "L", conforming to ASTM B 88 with cast-brass or wrought-copper sweat joint fittings using ASTM B 32, tin-antimony or Grade Sn96 tin-silver solder, and flux containing not more than 0.2 percent lead; or with ANSI B16.26 flare joint fittings. Piping under concrete slabs shall be copper tubing, soft-drawn, Type "K", conforming to ASTM B 88, without joints.

B. Ball Valves: Valve shall have two piece forged brass or cast bronze body, blowout proof stem, PTFE seats/seals, chrome plated ball and full port design. Valves sizes 1/4" - 2" shall be pressure rated to 150 WSP/600Wog and conform to MSS-SP 110 and certified to CSA, UL, and FM. Valves Sizes 2 1/2" - 3" shall be pressure rated to 150 WSP/400 WOG and conform to MSS-SP 110. Provide extension through insulation as required. Valve shall be equal to Kitz valve #69.

2.3 PLUMBING FIXTURES SCHEDULE: Fixtures shall be Kohler, Crane, Eljer or American Standard equal to manufacture’s numbers specified herein for identification of type.

A. WC-1, Watercloset for Handicapped: 1.6 Gal flush, wall hung (mount so that front lip is 17” high), Vitreous china, elongated bowl, siphon jet action, 1-1/2" to spud, quiet flush valve with a vacuum breaker and 1" angle stop, open front white seat with stainless steel self-sustaining check hinge.

1. Fixture: Kohler "Kingston" #K-4330 with
2. Seat: Bemis Commercial 1955SSCT
3. Valve, Manual: Equal to Sloan #111 flush valve.
4. Valve, Electronic, Wired: Equal to Sloan Optima sensor operated flushometer model # 111 ES-S 1.6 gal flush.
5. Valve, Electronic, Battery Solar: Flush valve shall be of the exposed type, top mount solenoid, battery operated, with a long battery life, and a five (5) year warranty. Flush valve shall be equal to Sloan Optima sensor operated flushometer model # 8111-1.6 gallon flush.
6. Valve, Electronic, Battery: Sloan top mount solenoid flush valve #G2-8111.

WALL-HUNG

B. L-1, Lavatory for Handicapped: Vitreous china lavatory, 20-1/2" x 18-1/4", concealed arms support, combination supply fitting gooseneck spout with aerator and 4" wrist blades, offset grid assembly, angle supplies with stops and flexible risers and 1-1/4" cast brass adjustable "P"

trap with cleanout and waste to wall. Lavatory shall be mounted so that bottom of front ledge is 30" above finish floor; insulate exposed hot water line and drain from direct contact.

1. Fixture: American Standard “Lucerne” #0356.41
2. Faucet, Battery Sensor: Sloan #EBF-650-BDM
3. Drain: Dearborn Brass #760W-1.
4. P-Trap: Dearborn Brass #707-1
5. Pipe Insulation: Lav-Guard 102EZ
6. Supply: Brass Craft #OCR1920AZ C

C. PLUMBING SPECIALTIES: Furnish and install the following plumbing specialties:

1. FD-1, Floor Drain: Equal to Josam #30003-A, Smith #2005-A (3") or Zurn #Z415 with Type B strainer. (Equal to Josam #30003-S, Smith #2005-A (3") or Zurn #Z415 with Type S strainer.) square
2. B-1, Condensate Box: Fire rated box with secondary drainage funnel trim ring and cover for condensate drainage of mechanical equipment. Box shall be equal to Sioux Chief Fire rated Ox Box 696R3 with 696-CF Secondary Drainage Funnel and 696-SC cover.

PART 3 – EXECUTION

3.1 INSTALLATION:

A. General: Installation of plumbing systems including fixtures, equipment, materials, and workmanship shall be in accordance with all local plumbing, building, and fire code requirements. When fixtures require both hot water and cold water supplies, provide the hot water supply to the left of the cold water supply. Plastic piping shall not penetrate fire rated walls, floors, or enclosures (including plenums) and shall be used on one side of fire rated partitions not closer than 6 inches to a penetration.

3.2 PREPARATION:

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
B. Verify adjacent construction is ready to receive rough-in work of this Section.

3.3 INSTALLATION:

A. Install specialties in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Install water hammer arresters complete with accessible isolation valve.

D. Install each fixture with chrome plated rigid or flexible supplies with stops, reducers, and escutcheons.

E. Adjust stops or valves for intended water flow rate to fixture without splashing, noise, or overflow.

F. While under construction, unattended exposed pipelines must have the ends capped. All materials to be used in construction shall be stored above the ground in a manner that will minimize the possibility of contamination.

END OF SECTION

SECTION 220090 – PLUMBING SYSTEM COMMISSIONING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Systems and equipment Start-Up and Functional Performance Testing.

B. Validation of proper and thorough installation of Division 22 systems and equipment.

C. Generic Startup Documentation for plumbing systems and equipment.

D. Development of final Startup Documentation for plumbing systems and equipment.

E. System Startup and Turn-Over procedures.

F. Systems balancing verification.

G. Coordination and execution of Training Events.

1.02 GENERAL DESCRIPTION

A. Commissioning (Cx) is the process of ensuring that (i) all building systems are installed and perform interactively according to the design intent; (ii) that systems are efficient and cost effective and meet the Owner's operational needs; (iii) that the installation is accurately documented; and (iv) that the Operators are adequately trained. Commissioning serves as a tool to minimize post- occupancy operational problems, and establishes testing and communication protocols to advance the building systems from installation to optimized, fully dynamic operation.

B. Commissioning Authority (CA) shall work with the Contractor and the design engineers to direct and oversee the Cx process and perform Functional Performance Testing.

C. The Commissioning Plan outlines the Cx process beyond the Construction Contract, including design phase activities and design team/owner responsibilities. The specification Sections dictate all requirements of the commissioning process relative to the construction contract. The Cx Plan is not part of the construction contract, although it is available for reference at the request of the Contractor.

D. This Section outlines the Cx procedures specific to the Division 23 Contractors. Requirements common to all Sections are specified in Section 019100 and Section 019110 This Section and other sections of the specification details the Contractor's responsibilities relative to the Cx process.

1.03 SCOPE

A. The following systems and equipment are included in the Scope of Commissioning for this project.

B. Plumbing Systems:

1. Plumbing fixtures.
2. Domestic cold water.

3. Domestic hot water.
4. Domestic hot water recirculation (including pumps).
5. Domestic water heaters.
6. Sanitary waste and vent.
7. Natural gas systems.

1.04 RELATED WORK AND DOCUMENTS

A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this specification and shall be used in conjunction with this section as part of the contract documents. See Division 01 for details.

B. The Cx process references many related Sections, particularly Section 019100 - General Commissioning Requirements. It is important for all Contractors subject to the Cx process to be familiar with Section 019100.

C. Section 019110 – General Commissioning Requirements for Functional Performance Testing.

D. Section 230800 – HVAC System Commissioning.

E. Section 260800 – Electrical Systems Commissioning.

1.05 DEFINITIONS AND ABBREVIATIONS

A. Refer to Section 019100 for a complete list of Definitions and Abbreviations.

1.06 REFERENCE STANDARDS

A. Refer to Section 019100 for a complete list of Definitions and Abbreviations.

B. ASHRAE Standard 202 – Commissioning Process for Buildings and Systems.

C. ASHRAE Guideline 0 – The Commissioning Process.

D. ASHRAE Guideline 1.1 – HVAC&R Technical Requirements for the Commissioning Process.

E. ASHRAE Guideline 1.3 – Building Operations and Maintenance Training for the HVAC&R Commissioning Process.

F. ASHRAE Guideline 1.4 – Procedures for Preparing Facility Systems Manual.

1.07 DOCUMENTATION

A. Documentation shall be as required in Section 019100. In addition, Contractor shall also provide to the CA the following per the procedures specified herein, in the Cx Plan, and in other Sections of the specification:

1. Factory Test Reports: Contractor shall provide any factory testing documentation or certified test reports required by the specifications. These shall be provided prior to the Acceptance Phase. Factory Test Reports should be provided in PDF electronic format. These may include but are not limited to:

a. Plumbing fixtures.

2. Field Testing Agency Reports (other than TAB): Provide all documentation of work of independent testing agencies required by the specification. These shall be provided prior to Acceptance Phase. Field Testing Agency Reports should be provided in PDF electronic format. These may include but are not limited to:

a. Pipe Pressure Testing.

3. TAB Plan: The Testing, Adjusting, and Balancing Plan shall include the following:

a. Certifications on all instruments to be used throughout the testing. Certification must be documented within the previous 6 months.
b. Résumés and Certification of individuals who will be balancing the systems.
c. Detailed step-by-step plans for each procedure to be performed by the TAB Contractor.
d. Sample forms to be used for each measurement.
e. Sample balancing report.

4. Piping Cleaning, Flush, and Fill Plan: Contractor shall provide this document in accordance with details in this Section. CA will review.
5. Temporary Operating and Conditioning Plan: Contractor shall provide in accordance with details in this Section. CA will review.
6. Completed TAB Reports. CA will review prior to FPT.

1.08 SEQUENCING AND SCHEDULING

A. Refer to Section 019100.

1.09 COORDINATION MANAGEMENT PROTOCOLS

A. Coordination responsibilities and management protocols relative to Cx are initially defined in Section 019100 and the Cx Plan, but shall be refined and documented in the Construction Phase Cx Kick-Off Meeting. Contractor shall have input into the protocols to be used and all Parties will commit to scheduling obligations. The CA will record and distribute.

1.10 CONTRACTOR RESPONSIBLITIES

A. Refer to Section 019100: Detailed Contractor responsibilities common to all Divisions are specified in Section 019100. The following are additional responsibilities or notable responsibilities specific to Division 22.

B. Construction Phase.

1. Provide skilled technicians qualified to perform the work required.
2. Provide factory-trained and authorized technicians where required by the Contract Documents.
3. Prepare and submit required draft Startup Documentation and submit along with the manufacturer’s application, installation, and startup information.
4. Provide assistance to the CA in preparation of the specific Functional Performance Test (FPT) procedures. Contractors, subcontractors, and vendors shall review FPT procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm

limits to be used during the tests. Damage caused to equipment performed in accordance with the approved procedures will be the responsibility of the Contractor.

5. Thoroughly complete and inspect installation of systems and equipment as detailed throughout Contract Documents, as required by reference or industry standards, and as specifically indicated elsewhere this Section.
6. Startup, test/adjust/balance, and Turn-Over systems and equipment prior to functional performance testing by the CA. Approved Startup Documentation shall be in accordance with Contract Documents, reference or industry standards, and specifically elsewhere in Part I of this Section.
7. Record Startup on approved Startup Documentation forms and certify that the systems and equipment have been started and or tested in accordance with the requirements specified above. Each task or item shall be indicated with the Party actually performing the task or procedure.

C. Acceptance Phase.

1. Assist CA in Functional Performance Testing. Assistance will typically include the following:

   a. Manipulate systems and equipment to facilitate Functional Performance Testing (as specified in Section 019100, Section 019110, and the Cx Plan; in some cases this will entail only an initial sample).
   b. Provide any specialized instrumentation necessary for Functional Performance Testing.

D. Warranty Phase.

1. Maintain record documentation of any configurations, setpoints, parameters, etc. that change throughout the Warranty Period.
2. Provide representative for off-season testing as required by CA.
3. Respond to warranty issues as required by Division 01 and the General Conditions.

1.11 EQUIPMENT SUPPLIER RESPONSIBILITIES

A. Refer to Section 019100.

1.12 CONTRACTOR NOTIFICATION AND SCHEDULING

A. Refer to Section 019100.

1.13 STARTUP DOCUMENTATION

A. Refer to Section 019100.

1.14 EQUIPMENT NAMEPLATE DATA

A. Refer to Section 019100.

1.15 FUNCTIONAL PERFORMANCE TESTING

A. Contractor shall participate in the initial samples of Functional Performance Testing as stipulated in Section 019100 and Section 019110.

1.16 FPT ACCEPTANCE CRITERIA

A. Acceptance criteria for tests are indicated in Section 019100 and in the specification Sections applicable to the systems being tested. Generally, unless indicated otherwise, the criteria for acceptance will be that specified with the individual system, equipment, component, or device.

1.17 TRAINING

A. Contractors, Subcontractor, Vendors, and other applicable Parties shall prepare and conduct training sessions on the installed systems and equipment they are responsible for per the requirements of Section 01 91 00 and the individual Specifications.

1.18 SYSTEMS MANUAL AND O&M DOCUMENTATION CONTENT

A. Refer to Section 019100.

PART 2 - PRODUCTS

2.01 INSTRUMENTATION

A. General: All testing equipment used by any Party shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:

1. Temperature sensors and digital thermometers shall have a certified calibration within the past year and a resolution of +/- 0.1F.
2. Pressure sensors shall have an accuracy of +/- 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.
3. All equipment shall be calibrated per the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.

B. Standard Testing Instrumentation: Standard instrumentation used for testing air and water flows, temperatures, humidity, noise levels, amperage, voltage, and pressure differential in air and water systems related to functional testing shall be provided by CA.

C. Special Tools: Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, per these Contract Documents shall be included in the base bid price to the Contractor and turned over to the Owner upon project completion.

2.02 TEST KITS FOR METERS AND GAUGES

A. Test kits for meters and gages shall be provided to the Owner new and in good condition. Previously used kits will be unacceptable. Kits shall be submitted prior to the Acceptance Phase. Kits included shall be as a minimum:

1. Digital indication of temperature and pressure with associated sensors to work with the P/T test ports.
2. Companion readout kit (with fittings) for calibrated balancing valve with ranges as required by all devices on this project.

PART 3 - EXECUTION

3.01 GENERAL STARTUP DOCUMENTATION

A. This Section outlines 'generic' or minimally acceptable Startup Documentation (which are defined to include both 'Startup Checks' and 'Startup Tests') and individual systems training requirements for systems and equipment. These procedures are the direct responsibility of the Contractor as a basic element of validating that the installation is correct per normal quality control practices. These items shall provide a minimally acceptable guideline for required Contractor development of Startup Documentation. Contractor shall synthesize these minimum requirements along with their own internal quality control practices, those of the manufacturer, and any applicable codes and standards to develop specific and itemized final Startup Documentation specific to the equipment and systems installed on this project.

B. Section 019100 defines the systems and equipment Startup process in detail and provides definitions for Startup Documentation, including the generic Startup Documentation provided below.

3.02 STARTUP DOCUMENTATION COMMON TO ALL SYSTEMS

A. The following Startup Documentation (Checklists and Tests) shall be considered common to all systems:

1. Checkout shall proceed from lower-level devices to larger components to the entire system operation.
2. Verify labeling is affixed per specification and visible.
3. Verify prerequisite procedures are done.
4. Inspect for damage and ensure none is present.
5. Verify system is installed per the manufacturer's recommendations.
6. Verify system has undergone Startup per the manufacturer's recommendations.
7. Verify that access is provided for inspection, operation, and repair.
8. Verify that access is provided for eventual replacement of the equipment.
9. Verify that record drawings, submittal data and O&M documentation accurately reflect the installed systems.
10. Verify all gauges and test ports are provided as required by contract documents and manufacturer's recommendations.
11. Verify all recorded nameplate data is accurate.
12. Verify that the installation ensures safe operation and maintenance.
13. Verify specified replacement material/attic stock has been provided as required by the Contract Documents.
14. Verify all rotating and moving parts are properly lubricated.
15. Verify all monitoring and ensure all alarms are active and set per Owner's requirements.
16. Complete all nameplate data and confirm that ratings conform to the design documents.

3.03 VALVES

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Startup Checks: Perform the following checks during startup and as specified in manufacturer's instructions:

1. Operate all valves, manual and automatic, through their full stroke. Ensure smooth operation through full stroke and appropriate sealing or shutoff.
2. Verify actuators are properly installed with adequate clearance.
3. Verify all valves are labeled per the construction documents. Confirm that concealed valves are indicated on the finished building surface.
4. For automatic pneumatically operated valves, verify spring range and adjust pilot positioners where applicable.
5. For electronically operated valves, check the stroke and range.
6. For all automated valves controlled by a program, ensure that the minimum and maximum stroke and ranges on the valves are coordinated with the limits entered in the program.

3.04 METERS AND GAUGES

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Startup Checks: Perform the following checks during startup and as specified in manufacturer's instructions:

1. Adjust faces of meters and gauges to proper angle for best visibility.
2. Clean windows of meters and gauges and factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touch-up paint.
3. For meters and gauges requiring temporary manual connection of read-out device such as pressure taps on a flow measuring device, ensure threads are clean and that connection can be made easily.
4. Meters and gauges requiring manual connection of readout device shall be installed with adequate access to allow connection of device with normal tools.

3.05 MECHANICAL IDENTIFICATION

A. Startup Checks: Perform the following checks:

1. Verify all valve tags, piping, duct, and equipment labeling corresponds with drawings and indexes and meets requirements specified. Correct any deficiencies for all piping and duct systems.
2. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.
3. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.06 MECHANICAL INSULATION

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Startup Checks: Examine all piping, systems and equipment specified to be insulated.

1. Ensure quality of insulation. Patch and repair all insulation damaged after installation.
2. Ensure the integrity of vapor barrier around all cold surfaces.

3.07 ALL PIPING

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Startup Checks: These procedures apply to all installed piping systems, including underground site utilities.

1. Inspect all piping for proper installation, adequate support (with appropriate vibration isolation where applicable) and adequate isolation valves for required service.
2. Submit welding certifications as required by the applicable specification section or referenced ASME specification.
3. Submit certified welding inspection results per the applicable specification section or referenced ASME specification. ASME B31.1 requires 100% inspection based on pressure class.
4. Provide notification of pipe cleaning and flushing activities.
5. Flush and clean all piping and clean all strainers. Provide documentation of all related procedures.
6. Ensure adequate drainage is provided at low points and venting is provided at high points.
7. Ensure facilities to effectively drain and fill the system are in place.
8. Ensure air is thoroughly removed from the system as applicable.
9. Ensure all piping is adequately supported and anchored to allow expansion. Bump across-the- line pumps and inspect for excessive pipe movement.
10. Provide notification of pressure testing.
11. Pressure and/or leak test all applicable systems in accordance with the requirements in the applicable sections, ASME B 31.1 and 39.1 as applicable.
12. Sterilize applicable piping systems as specified in the individual Sections and as required by regulatory authorities.
13. Submit pressure test reports that document the pressure testing results with certification of the results.
14. Verify the operation of applicable safety relief valves, operating controls, safety controls, etc. to ensure a safe installation.
15. Set and adjust fill, pressure, or level controls to the required setting.

3.08 PUMPS

A. Include all applicable ‘Start-Up Checks Common to All Systems”. Additional Start-Up Checks and Tests are as follows.

B. Refer to ‘AC Motors’ in this Section.

C. Refer to ‘Bearings’ in this Section.

D. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for detailed requirements for testing, adjusting, and balancing plumbing systems.

E. Start-Up Checks: Perform the following checks during start-up:

1. Check suction lines connections for tightness to avoid drawing air into the pump.
2. Clean and lubricate all bearings.
3. Check motor for proper rotation. Rotation shall match direction of rotation marked on pump casing.
4. Check that pump is free to rotate by hand. For pumps handling hot liquids, pump shall be free to rotate with the pump hot and cold. If the pump is bound or even drags slightly, do not operate the pump until the cause of the trouble is determined and corrected.
5. Clean associated strainers.
6. Check that the proper overloads have been installed in the starter and are the correct size.
7. Verify that the integrity of the vibration isolation is maintained throughout the support and the connections.
8. Align pump within manufacturers recommended tolerances.
9. Ensure all associated piping has been cleaned, tested, and deaerated.
10. Verify that all thermometers and gauges are installed, are clean and undamaged, and are functional.

F. Include all applicable ‘Start-Up Checks Common to All Systems”. Additional Start-Up Checks and Tests are as follows.

1. Start the pump per the manufacturer’s instructions.
2. Check the general mechanical operation of the pump and motor.
3. Verify that check-valve seal is appropriate.
4. Check noise and vibration levels and ensure they are within the manufacturer’s recommended tolerances.
5. Check that the NPSH is with that allowable for the operating condition.
6. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for detailed requirements for testing, adjusting, and balancing plumbing systems.

3.09 PLUMBING FIXTURES

A. Include all applicable ‘Start-Up Checks Common to All Systems”. Additional Start-Up Checks and Tests are as follows.

B. Start-Up Checks: Perform the following checks during start-up:

1. Inspect each installed fixture for damage. Replace damaged fixtures and components.
2. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.
3. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
4. Operate and adjust disposers, hot water dispensers, and controls. Replace damaged and malfunctioning units and controls.
5. Adjust water pressure at drinking fountains, electric water coolers, and faucets, shower valves, and flush-o-meters having controls, to provide proper flow and stream.
6. Replace washers of leaking and dripping faucets and stops.
7. Clean fixtures, fittings, and spout and drain strainers with manufacturers' recommended cleaning methods and materials.

3.10 WATER HEATERS

A. Include all applicable ‘Start-Up Checks Common to All Systems”. Additional Start-Up Checks and Tests are as follows.

B. General: Provide the services of a factory-authorized service representative to test and inspect unit installation, provide start-up service, and demonstrate and train Owner's maintenance personnel as specified below.

1. Check for adequate combustion air.
2. Check for piping connections leaks.
3. Check for clear vent.
4. Test and adjust operating and safety controls. Replace damaged and malfunctioning controls and equipment.
5. Training: Train Owner's maintenance personnel on procedures and schedules related to start-up and shutdown, troubleshooting, servicing, and preventative maintenance. Review data in Operating and Maintenance Manuals.

3.11 WORK SEQUENCE ILLUSTRATION

A. Reference Section 019100.

3.12 TRAINING

A. System training requirements are detailed in 019100.

END OF SECTION 230800

SECTION 22 05 00 BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Section 23 01 00 - Mechanical General Requirements, with modifications and additions specified herein, apply to the work specified in this Section.

1.2 SECTION INCLUDES:

A. Basic Piping Materials and Installation Procedures for All Piping Systems.

B. Identification, Labeling, and Marking.

C. Testing, Adjusting, and Balancing.

1.3 RELATED WORK SPECIFIED ELSEWHERE:

A. Type of pipe and fittings are specified under each piping system.

1.4 SUBMITTALS:

A. Submit product data and shop drawings under provisions of Section 23 01 00.

B. Submit noise and vibration isolation equipment data.

C. Submit pipe hanger and support data along with certificate of compliance.

D. Submit qualifications of testing and balancing firm.

E. Include testing and balancing procedures (agenda) along with proposed forms.

F. Submit final test and balance report.

1.5 QUALITY ASSURANCE:

A. Agency: Testing and balancing agency shall be a company specializing in this type work for a minimum of three documented years and certified by AABC or NEBB.

B. Welder Certification: In conformance with AWS D1.1.

C. For each product, provide components by the same manufacturer throughout.

D. Use domestic pipe, pipe fittings, valves, and motors on this project when available unless other specified.

PART 2 - PRODUCTS

2.1 NOISE AND VIBRATION ISOLATION

A. Provide neoprene pads for all floor, base, and pad mounted equipment in accordance with ASHRAE A47.

B. Provide spring and rubber type vibration isolators for all hanging equipment.

2.2 BASIC PIPING MATERIALS:

A. Gate Valves: Valves up to 2-inch size shall have bronze body, bronze trim, inside screw, rising stem with hand-wheel, single wedge or disc, solder or threaded ends, Crane No. 1324, NIBCO No. S-126 or equal. Valves over 2-inches shall have iron body, bronze trim, rising stem with hand-wheel, OS&Y, double wedge, flanged ends.

B. Butterfly Valves: Not accepted.

C. Globe Valves: Valves up to 2-inch size shall have bronze body, bronze trim, rising stem and hand-wheel, inside screw, renewable composition disc, solder or screw ends to match adjacent piping, with back-seating capacity, and repackable under pressure. Valves over 2-inch size shall have iron body, bronze trim, rising stem, hand-wheel, OS&Y, plug type disc, flanged ends, renewable seat and disc.

D. Ball Valves: Valves up to 2-inch size shall have bronze or stainless steel body, stainless steel ball, Teflon seats and stuffing box ring, lever handle, solder or threaded ends. Valves over 2-inch size shall have cast steel body, stainless steel ball, Teflon seat and stuffing box seals, lever handle, flanged ends.

E. Plug Cocks: Plug cocks up to 2-inch size shall have bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends, with wrench operator. Plug cocks over 2-inch shall have iron body and plug, pressure lubricated, Teflon packing, flanged ends, with wrench.

F. Swing Check Valves: Valves up to 2-inches shall have bronze body, 45 degree swing disc, solder or screwed ends. Valves over 2-inches shall have iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.

G. Spring Loaded Check Valves: Iron body, bronze trim spring loaded, renewable composition disc and seat, screwed, wafer, or flanged ends.

H. Strainers: Strainers up to 2-inches shall screwed brass or iron body, Y-pattern with stainless steel screen. Strainers over 2-inches shall have flanged iron body, Y-pattern with stainless steel screen.

I. Escutcheon Plates: One piece or split hinge type metal plates for piping passing through floors, walls, and ceilings in exposed spaces, chromium-plated finish on plates in finished spaces, paint on plates in unfinished spaces, and with set screws to anchor plates in place securely.

J. Unions: For pipe sizes under 2-inches use 150 psig malleable iron unions for threaded ferrous piping; bronze unions with solder joints for copper pipe.

K. Flanges: For pipe size over 2-inches use forged steel slip-on flanges conforming to ANSI B16.1, Class 125, for use in ferrous piping; Bronze flanges conforming to ANSI B16.22 or B16.24 for use in copper tubing. Gaskets shall be full face flat type synthetic rubber, except use neoprene gaskets for gas service and shall conform with ANSI B16.21

L. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, except both ends threaded for gas service, water impervious isolation. Use unions as manufactured by EPCO.

M. Access Doors: Provide, 12" x 12" minimum size, factory prefabricated flush face steel access doors including steel door frame with continuous hinges and turn-screw-operated latch. Door frame shall be for installation in dry walls, plaster walls, or masonry walls. Furnish doors under this section to provide proper access to concealed valves; install doors under the appropriate section of this specification.

N. Pipe Sleeves: Sleeves in masonry and concrete walls, partitions, floors, and roofs shall be constructed of, Schedule 40, hot-dipped galvanized, pipe conforming to ASTM A53. Sleeves in other type construction shall be constructed of steel sheet having a nominal weight of not less than 0.90 pounds per square foot.

O. Flashing: Flashing for pipes passing through roof or waterproofing membrane shall be fabricated from 4-pound per square foot sheet lead. Flashing for plumbing vents through metal roof shall be made water-tight by special flashing obtained from the roof manufacture.

P. Pipe Hangers and Supports: Provide MSS SP-58 and MSS SP-69, Type 1 or 6 of adjustable type. Attachments to steel W or S beams shall be with Type 21, 28, 29, or 30 clamps. Attachments to steel angles and channels (with web vertical) shall be with Type 20 clamp with beam clamp channel adaptor. Attachments to steel (with web horizontal) shall be with drilled hole on centerline and double nut and washer. Attachment to concrete shall be with Type 18 insert or drilled hole with expansion anchor. Attachment on roof shall be structural design with mechanically attached foam base, saddle for aligning pipe, and use of 3/8” or ½” threaded rod, equal to Roof Top Blox. Hanger rods and attachments shall be full size of the hanger threaded diameter. Provide Type 40 insulation protection shields for insulated piping. Provide steel support rods. Provide nonmetallic, hair felt or plastic piping isolators between copper tubing and the hangers or use copper hangers.

Q. Tracer Wire for Nonmetallic Pipe: Tracer wire shall be bare copper wire not less than 0.10 inch in diameter and shall be continuous over entire length of nonmetallic pipe.

2.3 Identification:

A. Stencils: With clean cut symbols and letters.

B. Stencil Paint: In accordance with Section 09900, semi-gloss enamel.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.4 Adjusting, Balancing & Testing:

A. General: The Contractor shall procure the services of an independent balance

and testing firm, approved by the Architect which specializes in the balancing and testing of heating, ventilating and air conditioning systems; to balance, adjust, and test the mechanical systems performance in accordance with the contract plans and specifications.

B. Quality: The testing firm shall be a member of Associated Air Balance Council. All work by this firm shall be done under direct supervision of a qualified engineer employed by them. The air balance firm shall provide proof of having successfully completed at least five projects of similar size and scope. All instruments used by this firm shall be accurately calibrated and maintained in good working order. If requested, the tests shall be conducted in the presence of the Contracting Officer.

C. Testing: Balance and testing shall not begin until system has been completed and is in full working order. The Contractor shall put all heating, ventilation, and air conditioning systems and equipment into full operation and shall continue the operation of same during each working day of testing and balancing.

D. Submittal: The Contractor shall submit six (6) copies of submittal data for the testing and balancing of the air conditioning, heating and ventilating systems.

E. Warranty: Balance firm shall include and extended warranty of 90 days, after completion of work, during which time the Architect, at his discretion, may request a re-check of resetting of any water flow, outlet, supply air fan, or exhaust fan as listed in test report.

PART 3 - EXECUTION

3.1 NOISE CONTROL AND VIBRATION ISOLATION:

A. Vibration Absorbing Supports: All items of mechanical piping and equipment, including compressors and pumps, shall be properly isolated from the building structure by means of approved vibration-absorbing supports or foundations. Each unit shall consist of machine and floor or foundation together with intermediate isolation materials. The isolation units shall be standard catalog products with printed loading ratings. The support for each piece of equipment shall be submitted for approval.

3.2 INSTALLATION OF PIPING:

A. Preparation:

1. Ream pipe and tube ends. Remove burrs. Bevel plain end of ferrous pipe.

2. Remove scale and dirt, on inside and outside of piping before assembly.

3. Prepare piping connections to equipment with flanges or unions.

4. Coordinate cutting or forming of roof or floor construction to receive drains to required invert elevations.

B. Installation:

1. Provide non-conducting dielectric connections whenever jointing dissimilar metals. Locate in accessible locations.

2. Install piping to conserve building space and not interfere with use of space. Group piping whenever practical at common elevations. Route piping in an orderly manner, plumb, and parallel with the lines of the structure, and maintain gradient.

3. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

4. Install specialties and equipment in accordance with manufacturer's instructions.

5. Install brass male adapters each side of valves in copper piped systems. Sweat solder adapters to pipe.

6. Provide clearance for installation of insulation and access to valves and fittings.

7. Slope water piping and arrange to drain at low point.

C. Application:

1. Install specialties in accordance with manufacturer's instructions.

2. Install brass male adapters each side of valves in copper piped systems. Sweat solder adapters to pipe.

3. Install globe, plug cock, or ball valves for throttling, by-pass, or manual flow control services.

4. Install tracer wire over underground nonmetallic pipe.

5. Threaded Connections: Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape, pipe cement and oil, or PTFE powder and oil; apply only on male threads. Provide exposed ferrous pipe threads with one coat of primer applied to a minimum dry film thickness of 1.0 mil.

6. Solder End Valves: Remove stems and washers and other items subject to damage by heat during installation. Reassemble valve after soldering is completed. Valves without heat sensitive parts do not require disassembly but shall be opened at least two turns during soldering.

7. Pipe Hangers and Supports: Support horizontal piping as follows:

PIPE SIZE	MAXIMUM HANGER SPACING	HANGER ROD DIAMETER
½ TO 1-1/4 INCH	6’-0”	3/8”
1-1/2 TO 2 INCH	8’-0”	3/8”
2-1/2 TO 3 INCH	10’-0”	½”

4 TO 6 INCH	12’-0”	5/8”
8 TO 12 INCH	14’-0”	7/8”
PLASTIC – ALL SIZES	4’-0” & AT ELBOWS	3/8”
CAST IRON PIPE	5’-0” & AT JOINTS	5/8”

8. Pipe Sleeves: Provide pipe sleeves where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than 0.25-inch space between exterior of piping or pipe insulation and interior of sleeve. Firmly pack space with insulation and calk at both ends of the sleeve with plastic waterproof cement which will dry to a firm but pliable mass, or provide a segmented elastomeric seal. Seal both ends of penetrations through fire walls and fire floors to maintain fire resistive integrity with UL listed fill, void, or cavity material. Extend sleeves in floor slabs 3 inches above the finished floor, except sleeves are not required where DWV piping passes through concrete floor slabs located on grade.

9. Flashing: Pipes passing through roof or floor waterproofing membrane shall be installed through lead flashing within an integral skirt or flange. Flashing shall be suitable formed and the skirt or flange shall extend not less than 8-inches from the pipe and shall set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 8-inches. The annular space between the flashing and the bare pipe shall be sealed. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. A sheet-lead flashing shield shall be provided for floor drains and pipe sleeves with integral clamping devices that penetrate a membrane. Flashing shield shall be made from sheet lead and extend not less than 8-inches from the drain or sleeve in all directions. Flashing shall be inserted into the clamping device and made watertight.

10. Flanges and Unions: Flanges shall be faced true. Flanges shall be provided with gasket and made square and tight. Except where copper tubing is used, union or flange joints shall be provided in each line preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items. A union shall be installed on the downstream of each valve.

11. Grading: Connections shall be carefully made to insure unrestricted circulation or flow, eliminate air pockets and permit draining of all systems. Hot and chilled water lines shall have a grade of not less than 1" in 40' up in the direction of flow to the high point air vent. Steam and steam condensate lines shall have a grade of not less than 1" in 20' down in the direction of flow. Use eccentric reducers to maintain top of heating and chilled water piping at proper grade and to maintain bottom of steam and steam condensate piping

at proper grade.

12. Valve Stems: Valves in horizontal lines shall be installed with stems horizontal or above.

D. Welding

1. Welded Joints: Welded joints shall be fusion-welded in accordance with ANSI B31.1, Section 6. Mitering or notching of pipe to form elbows or tees or other similar construction will not be permitted.

2. Beveling: Field and shop bevels shall be in accordance with the recognized standards and shall be done by mechanical means or flame cutting. Where beveling is done by flame cutting, surfaces shall be cleaned of scale and oxidation prior to welding.

3. Alignment: Before welding, the components parts to be welded shall be aligned so that no strain is placed on the weld when finally positioned. Height shall be so aligned that no part of the pipe wall is offset by more than 20% of the wall thickness. Flanges and branches shall be set true. This alignment shall be preserved during the welding operation.

4. Removing and Replacing Defective Welds: Shall be at no additional cost to the owner. Repairing defective welds by adding new materials over the defects or by peening will not be permitted.

5. Electrodes: Electrodes shall be stored in a dry heated area and shall be kept free of moisture or dampness during fabrication operations. Electrodes that have lost part of their coating shall be discarded.

6. Welding to Structure: Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

3.3 IDENTIFICATION, LABELING AND MARKING:

A. General: Piping, valves, controls, and equipment shall be labeled or marked. Manufactured name plates and labels such as Brady or Seton will be acceptable and the Contractor is invited to submit, for examination and test, samples of materials he proposes to use.

B. Piping: On all piping, stencil name of liquid or gas being handled, and direction of flow in contrasting colors. In general stencils shall be on piping at 20 foot intervals and near all operating valves & equipment. Lines less than 3/4" total diameter to be identified with brass tags, lines 1" to 2" to have 3/4" high stencils, lines 2-1/2" to 7" to have 1-1/2" high stencils and all larger lines to have 2" high stencils. Sizes given are after insulation is applied.

C. Equipment: All apparatus, equipment, machines, controlling devices, controlled devices, starters, and switches are to be identified by name and number. Do not place label on cover or shield which is removable or interchangeable with other pieces. On all major equipment it shall be painted in prominent spots as selected.

Number all boilers, fans, pumps, etc., as well as label.

D. Valve Tags: All valves shall be provided with a nickel-plated brass tag not less than 1-1/2" in diameter with stamped numbers. Tag shall be secured to the valves with approved type S hooks. Also provide and mount under glass in the equipment room a typewritten valve list, listing functions of each valve, its location and service.

3.4 TESTING, ADJUSTING, AND BALANCING:

A. General Requirements: All equipment and apparatus necessary for balancing and testing shall be furnished by the Contractor. All defects disclosed by the tests shall be rectified without additional cost to the Owner. Field tests shall be made under the direction and subject to the approval of the Commissioning agent and DOR.

B. Piping Systems: Shall be tested after installation and before any insulation is applied. All controls and other apparatus that may be damaged by the test pressure shall be removed before the tests are made. Leaking screw and solder joints shall be remade. Welded joint leaks shall be repaired by cutting the section out of the system and rewelded. Tests shall be made by the Contractor and the results submitted for approval. Each system shall be hydrostatically tested as outlined in applicable codes and standards. Test pressure shall be maintained for no less than 2 hours. No tar, grease, paint or any other compound shall be used to repair leaks.

C. Operational Test: After the above testing all mechanical systems shall be started and operated to prove proper functioning of each type of equipment. Start-up and adjustment of the heat pumps shall be accomplished by the manufacturer's start-up Engineer. All operating tests shall be to the satisfaction of the Architect. Should any element not perform properly, the Contractor shall make all required corrections.

D. The balance and testing firm shall test, balance, adjust and record the following for all systems as applicable. Applicable system work shall be the new DX split system in the apartment, the new AHU in mechanical room, and the existing loop pumps serving the facility.

1. Test and adjust all blower RPM to design requirements.
2. Test and record all motor full load amperes.
3. Test and record system static pressure, suction and discharge.
4. Test and adjust system for design recirculated air, CFM.
5. Test and adjust system for design CFM outside air. Provide calibration of flow stations as applies.
6. Test and Adjust the AHU water for correct GPM and record. Set balance valves and mark setpoint locations.

7. Test and Adjust the chill water and hot water pumps for system for original settings. Prior to any work obtain baseline readings of the pumps.

8. Test and record entering air temperatures.

9. Test and record leaving air temperatures.

10. Test and adjust each diffuser, grilles and register to within ten percent of design requirements. Each grille, diffuser and register shall be identified as to location and area. Size, type, and manufacture of diffusers, grilles, registers, and all test equipment shall be identified and listed. Manufacturer's ratings on all equipment shall be used to make required calculation.

11. In cooperation with the control manufacturer's representative, setting adjustment of automatically operated dampers to operate as specified, indicated and/or noted. Testing agency shall check all controls for proper calibrations and list all controls requiring adjustment by control installers.

E. Performance Test: After completion of testing, balancing and adjusting the balance and testing firm shall make performance test of all mechanical system to determine compliance with the specification requirements. Any equipment that fails to equal or to exceed the specified performance shall be modified or replaced at no additional cost to the Owner.

F. Test Data: The Contractor shall furnish to the Architect four (4) copies of the schedules of readings taken during the balance and testing operation indicating the required to specified reading and the final balanced reading of all items.

SECTION 23 00 00 HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Section 23 01 00 - Mechanical General Requirements, with modifications and additions specified herein, apply to the work specified in this Section.

1.2 SECTION INCLUDES:

A. Air Handling Unit

B. Exhaust Fans and Accessories

C. Chemical feed Systems

D. Heat Pump

1.3 QUALITY ASSURANCE:

A. Fan Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

B. Fan Sound Ratings: AMCA 301; tested to AMCA 300 and bear AMCA Certified Sound Rating Seal.

C. Fan Fabrication: Conform to AMCA 99 and/or ARI 430.

1.4 SUBMITTALS:

A. Submit product data and shop drawings under provisions of Section 23 01 00.

B. Submit manufacturer's installation instruction.

C. Provide one (1) extra set of filters.

PART 2 - PRODUCTS

2.1 AIR HANDLING UNITS:

A. General: Air handling units shall be factory-fabricated, single-zone draw-through type and shall be complete with air-tight insulated enclosure, waterproof drain pan, coils, blowers, motor adjustable V-belt drive, belt guard, filter, filter box, access doors, vibration isolators, and other appurtenances necessary for satisfactory operation. The air handling unit shall conform to the provisions of Air Conditioning and Refrigeration Institute Standard 430.

B. Casing: The double wall casing shall be constructed of not lighter than 18-gauge galvanized steel. The drain pan shall be constructed of stainless steel sloped for positive drainage. The casing shall be insulated with foam within double wall and be thermally broke at joints. Provide hinged doors with locking handles for filters and fan access. Provide mixing box filter section with opposed blade dampers for osa and return duty.

C. Fans: Fans shall be of the centrifugal, double inlet blower type, with

forward-curved blades or plenum plug style. Fans shall be statically and dynamically balanced, mounted on a common shaft and shall run on permanently lubricated bearings. Fans shall be direct driven using VFD for speed control or ECM. Fan motor shall be resiliently supported within the unit casing on spring type frame with wheel.

D. Coils: Coils shall be of fin-and-tube type, arranged in a rectangular form to suit the space requirements, within the casing. Coils shall be properly supported by means of suitable frames constructed of galvanized-steel angles, or other approved devices. Coils shall be constructed entirely of nonferrous alloys with the fins securely bonded to the tubes. Coils shall be tested pneumatically and proved tight under a gauge pressure of 300 psi. Cooling coils shall be provided with a suitable condensation gutter and a trapped drain line. Water coils shall be provided with threaded pipe connections and an air vent connection. All coils shall be ARI rated.

E. Air Filter: Sectional 2" air filters of the MERV 8 throwaway type, approved by the Underwriters' Laboratories, Inc., shall be installed in suitable dust-tight racks at the suction side of the supply fan. Each filter section shall be two-inch-thick.

F. Spring Type Vibration: Spring Type Vibration isolators shall be provided with each air handling unit. Isolators shall be sized and furnished by unit manufacturer.

G. Manufacturer: Trane , Carrier, Daiken

2.2 EXHAUST FANS AND ACCESSORIES:

A. General: This Contractor shall furnish and install all exhaust fans. Fans shall be of the sizes and types shown on the Drawings and shall be complete with all accessories and specials scheduled. Fans shall be rated in accordance with AMCA Standards and shall be AMCA labeled. All fractional horsepower motors shall be provided with internal overload protections.

B. Ceiling Mounted Fans: Fans shall be of the centrifugal direct drive type. Each fan shall have a removable front grille and gravity discharge damper. Interior of fan housing shall be lined with sound deadening insulation. Provide appropriate roof jack or wall discharge grille and connecting ductwork. Fans shall be Greenheck Model SP-A, Cook Model GC, Twin City Fan Model T, Broan, or approved equal.

2.3 CHEMICAL FEED SYSTEM: Contractor shall consult Owners present chemical treatment contractor and pay for and obtain service for one month to test water, set up and adjust equipment, provide chemicals, and instruct maintenance personnel. Provide this service for both the hot water and chill water systems.

2.4 HEAT PUMP:

A. General: Furnish and install an air-to-air electric heat pump system consisting of a fan coil unit, remote refrigeration unit, and supplementary electric heat. The system shall conform to the requirements of ARI Standard 240 and shall

be UL approved.

B. Outdoor Section: The outdoor section shall consist of compressor unit, air-cooled coil, air circulatory fan, housing, controls, frame and cabinet. The coil shall be protected by a grille. The cabinet shall be finished with baked enamel or other suitable weatherproof finish.

C. Indoor Section: The indoor section shall consist of a fan/coil unit. The coil shall be provided with a drain pan of nonferrous material or with a steel pan completely waterproofed with non-hardening type mastic on the water side. The supply air fan shall be of the centrifugal type, quiet in operation and capable of supplying the CFM and static pressure indicated. The fan/coil unit cabinet shall be insulated with mineral wool to prevent seating. The unit shall be mounted on vibration absorbing supports.

D. Supplementary Heat: Supplementary heat shall be of the electric resistance type and shall be installed downstream from the indoor coil. Heating elements shall have factory wired magnetic contactors and high temperature cutout devices. One stage of the heat shall be provided with an outside air thermostat.

E. Controls: The cooling/heating system shall be protected by high and low pressure stat, loss of charge and indoor coil freeze-up protection devices, current and temperature-sensitive compressor motor protectors, a device which prevents starting of the compressor more than once every 5 minutes, and a defrost circuit which senses for frost accumulation every 90 minutes and, if frost is present, automatically puts the unit into defrost cycle.

F. Thermostats: A deluxe wall mounted heating/cooling (two (2) stage heating, one (1) stage cooling) thermostat shall be installed. The thermostat shall be equipped with a system selector switch, blower switch for automatic or continuous operation and built-in heat and cool anticipation.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install equipment in accordance with manufacturer's installation instruction.

B. Coordinate installation with architectural, structural, mechanical, and electrical work.

C. Pipe drains to floor drain.

D. Clean and flush system before placing in operation.

E. Verify that the proper utilities are connected and ready for use before operation of equipment.

END OF SECTION

SECTION 230090 – HVAC SYSTEM COMMISSIONING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Building Automation System (BAS) Startup and Functional Performance Testing.

B. Validation of proper and thorough installation of Division 23 systems and equipment.

C. Generic Startup Documentation for mechanical systems and equipment.

D. Development of final Startup Documentation for mechanical systems and equipment.

E. System Startup and Turn-Over procedures.

F. Systems balancing verification.

G. Coordination and execution of Training Events.

1.02 GENERAL DESCRIPTION

A. Commissioning (Cx) is the process of ensuring that (i) all building systems are installed and perform interactively according to the design intent; (ii) that systems are efficient and cost effective and meet the Owner's operational needs; (iii) that the installation is accurately documented; and (iv) that the Operators are adequately trained. Commissioning serves as a tool to minimize post- occupancy operational problems, and establishes testing and communication protocols to advance the building systems from installation to optimized, fully dynamic operation.

B. Commissioning Authority (CA) shall work with the Contractor and the design engineers to direct and oversee the Cx process and perform Functional Performance Testing.

C. The Commissioning Plan outlines the Cx process beyond the Construction Contract, including design phase activities and design team/owner responsibilities. The specification Sections dictate all requirements of the commissioning process relative to the construction contract. The Cx Plan is not part of the construction contract, although it is available for reference at the request of the Contractor.

D. This Section outlines the Cx procedures specific to the Division 23 Contractors. Requirements common to all Sections are specified in Section 019100 and Section 019110. This Section and other sections of the specification details the Contractor's responsibilities relative to the Cx process.

1.03 SCOPE

A. The following systems and equipment are included in the Scope of Commissioning for this project.

B. Mechanical/HVAC Systems: All Division 23 equipment and systems are subject to commissioning, including but not limited to the systems listed below. All components and devices (sensors, valves, etc.) that make up these systems are included.

1. Air Handling Units (AHU).
2. Fan Coil Units (FCU).
3. CHW Hydronic Pumping System.
4. HW Hydronic Pumping System.
5. Boilers.
6. Chillers.
7. Packaged and Rooftop HVAC Units.
8. Supply, Return, Relief, Exhaust Air systems.
9. Commissioning execution and coordination with Division 23 requirements for BAS Integration

C. Building Automation System (BAS).

1. The BAS and all BAS Sub-Systems shall be subject to commissioning, including all hardware components, software, networking, programming, and engineering services, and controls documentation.

1.04 RELATED WORK AND DOCUMENTS

A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this specification and shall be used in conjunction with this section as part of the contract documents. See Division 01 for details.

B. The Cx process references many related Sections, particularly Section 019100 - General Commissioning Requirements. It is important for all Contractors subject to the Cx process to be familiar with Section 019100.

C. Section 019110 – General Commissioning Requirements for Functional Performance Testing.

D. Section 220800 – Plumbing System Commissioning.

E. Section 238060 – BAS Commissioning.

F. Section 260800 – Electrical Systems Commissioning.

1.05 DEFINITIONS AND ABBREVIATIONS

A. Refer to Section 019100 for a complete list of Definitions and Abbreviations.

1.06 REFERENCE STANDARDS

A. Refer to Section 019100 for a complete list of Definitions and Abbreviations.

B. ASHRAE Standard 202 – Commissioning Process for Buildings and Systems.

C. ASHRAE Guideline 0 – The Commissioning Process.

D. ASHRAE Guideline 1.1 – HVAC&R Technical Requirements for the Commissioning Process.

E. ASHRAE Guideline 1.3 – Building Operations and Maintenance Training for the HVAC&R Commissioning Process.

F. ASHRAE Guideline 1.4 – Procedures for Preparing Facility Systems Manual.

1.07 DOCUMENTATION

A. Documentation shall be as required in Section 019100. In addition, Contractor shall also provide to the CA the following per the procedures specified herein, in the Cx Plan, and in other Sections of the specification:

1. Factory Test Reports: Contractor shall provide any factory testing documentation or certified test reports required by the specifications. These shall be provided prior to the Acceptance Phase. Factory Test Reports should be provided in PDF electronic format. These may include but are not limited to:

    a. Air Handling Units.
    b. Chillers.
    c. Variable Frequency Drives.
    d. Fans Capacity.
    e. Fan Sound Power Levels.
    f. Boilers.

2. Field Testing Agency Reports (other than TAB): Provide all documentation of work of independent testing agencies required by the specification. These shall be provided prior to Acceptance Phase. Field Testing Agency Reports should be provided in PDF electronic format. These may include but are not limited to:

    a. Pipe Pressure Testing.
    b. Duct Air Leakage Testing.
    c. Vibration Testing.
    d. Water Treatment.

3. TAB Plan: The Testing, Adjusting, and Balancing Plan shall include the following:

    a. Certifications on all instruments to be used throughout the testing. Certification must be documented within the previous 6 months.
    b. Résumés and Certification of individuals who will be balancing the systems.
    c. Detailed step-by-step plans for each procedure to be performed by the TAB Contractor.
    d. Sample forms to be used for each measurement.
    e. Sample balancing report.
    f. All referenced charts such as Vibration Severity Charts and Room Noise Criteria (NC) curves.

4. Piping Cleaning, Flush, and Fill Plan: Contractor shall provide this document in accordance with details in this Section. CA will review.
5. Temporary Operating and Conditioning Plan: Contractor shall provide in accordance with details in this Section. CA will review.
6. Completed TAB Reports. CA will review prior to FPT.

1.08 SEQUENCING AND SCHEDULING

A. Refer to Section 019100.

1.09 COORDINATION MANAGEMENT PROTOCOLS

A. Coordination responsibilities and management protocols relative to Cx are initially defined in Section 019100 and the Cx Plan, but shall be refined and documented in the Construction Phase Cx Kick-Off Meeting. Contractor shall have input into the protocols to be used and all Parties will commit to scheduling obligations. The CA will record and distribute.

1.10 CONTRACTOR RESPONSIBILITIES

A. Refer to Section 019100: Detailed Contractor responsibilities common to all Divisions are specified in Section 019100. The following are additional responsibilities or notable responsibilities specific to Division 23.

B. Construction Phase.

1. Provide skilled technicians qualified to perform the work required.
2. Provide factory-trained and authorized technicians where required by the Contract Documents.
3. Prepare and submit required draft Startup Documentation and submit along with the manufacturer's application, installation, and startup information.
4. Provide assistance to the CA in preparation of the specific Functional Performance Test (FPT) procedures. Contractors, subcontractors, and vendors shall review FPT procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests. Damage caused to equipment performed in accordance with the approved procedures will be the responsibility of the Contractor.
5. Thoroughly complete and inspect installation of systems and equipment as detailed throughout Contract Documents, as required by reference or industry standards, and as specifically indicated elsewhere this Section.
6. Startup, test/adjust/balance, and Turn-Over systems and equipment prior to functional performance testing by the CA. Approved Startup Documentation shall be in accordance with Contract Documents, reference, or industry standards, and specifically elsewhere in Part I of this Section.
7. Record Startup on approved Startup Documentation forms and certify that the systems and equipment have been started and or tested in accordance with the requirements specified above. Each task or item shall be indicated with the Party actually performing the task or procedure.
8. TAB: As outlined in Section 23 05 93. Specifically, as it relates to Cx:

    a. Attend Construction Phase Cx Kick-Off Meeting and Cx progress meetings beginning within 3 months of start of TAB work.
    b. Submit TAB Plan as indicated above.
    c. Meet with Cx team to review TAB procedures and documentation required.
    d. Demonstrate TAB procedures for repetitive tasks (zone balancing, AHU adjusting) as called for by the CA.
    e. Participate in Action List dialogue.
    f. Provide all documentation electronically.
    g. Attend a meeting convened by the CA to coordinate with the safety certifying agency. The point of the meeting will be to coordinate protocols and measurement approaches to ensure that devices such as fume hoods and biosafety cabinets will be set up to achieve certification.

C. Acceptance Phase.

1. Assist CA in Functional Performance Testing. Assistance will typically include the following:

a. Manipulate systems and equipment to facilitate Functional Performance Testing (as specified in Section 019100, Section 019110, and the Cx Plan; in some cases this will entail only an initial sample).
b. Provide any specialized instrumentation necessary for Functional Performance Testing.
c. Manipulate BAS and other control systems to facilitate Functional Performance Testing (as specified in Section 019100, Section 019110, and the Cx Plan; in some cases, this will entail only an initial sample).
d. Provide a TAB technician to work at the direction of CA for up to 16 hours beyond assistance specified above.
e. Provide a BAS technician to work at the direction of CA for up to 16 hours beyond assistance specified above.

D. Warranty Phase.

1. Maintain record documentation of any configurations, setpoints, parameters, etc. that change throughout the Warranty Period.
2. Provide representative for off-season testing as required by CA.
3. Respond to warranty issues as required by Division 01 and the General Conditions.

1.11 EQUIPMENT SUPPLIER RESPONSIBILITIES

A. Refer to Section 019100.

1.12 CONTRACTOR NOTIFICATION AND SCHEDULING

A. Refer to Section 019100.

1.13 STARTUP DOCUMENTATION

A. Refer to Section 019100.

1.14 EQUIPMENT NAMEPLATE DATA

A. Refer to Section 019100.

1.15 PIPING CLEANING, FLUSH AND FILL PLAN

A. Contractors shall provide a “Piping Cleaning, Flush, and Fill Plan” to the CA that provides a descriptive narrative and supporting calculations of the means and methods that will be used to clean out, flush, and fill the piping systems.

B. The “Piping Cleaning, Flush, and Fill Plan” shall incorporate and be inclusive of all requirements of individual Divisions and Sections relating to piping and pipe cleaning and flushing. In addition to the requirements of any other related Section, this document shall consist of the following at a minimum for each individual hydronic loop:

1. Overview schematic diagram of each of the hydronic systems, showing individual flow components such as chillers, boilers, pumps, heat exchangers, cooling towers, control valves, and strainers.

2. Narrative and illustration indicating the equipment that will either participate or be bypassed by fluid flow during the clean and flush process.
3. For equipment to be bypassed, description of the means for providing the bypass, including the type, size, and length of hoses, or piping to be used.
4. Description of how flow is to be induced (permanent pumps, temporary pumps, etc.) and flow rates to be imposed during the flush process.
5. Calculation of resultant flow velocities in various portions of the piping system, with specific identification of the minimum velocity sections of the piping loop. Velocities should generally be shown to be above a 7 feet-per-second minimum speed to provide for adequate capability to flush and carry debris through the system to the appropriate strainer or clean-out location.
6. Description of cleaning methods and materials to be used to flush the system. Description shall include cleaning material and concentration, details of the cleaning process including duration of circulation and flushing intervals, criteria for determining a “clean” flush, and name and qualifications of cleaning or chemical treatment subcontractors to be used.
7. Identification and discussion of any isolated sections or ‘dead-legs’ that will be present, including means to provide cleaning and flushing for these sections.
8. Details of the strainers to be used for the flush and clean process, as well as final strainers to be used after cleaning. Contractor shall clean all strainers prior to turning over the system for commissioning.
9. If the cleaning and flushing process is to be phased in sections, details should be provided to clarify how clean sections will be protected as other sections are flushed.

1.16 TEMPORARY OPERATION AND CONDITIONING PLAN

A. Contractor shall be allowed to use permanent building equipment to provide temporary conditioning ONLY upon the approval of the A/E, Owner, and the CA. Approval for such will only be given upon acceptance of a detailed Temporary Operating and Conditioning Plan provided by the individually involved subcontractors and compiled by the CM. The Temporary Operating and Conditioning Plan shall consider/address the following at a minimum:

1. Indicate that the full Startup protocol, including development and documentation of Startup Documentation as required by the specification will be performed for the temporary startup. The Temporary Conditioning Plan shall include the Startup Documentation to be used, which shall be the same as those that will be used for final Startup.
2. Contractor shall address how equipment will be maintained in good, clean condition. Specifically address:

    a. Temporary Filtering of Air: Air filters used for construction shall be as or more effective than those specified for permanent use. Contractor shall remove construction filters and replace with new filters prior to FPT. Filters shall be maintained and replaced at the specified final pressure drop. Contractor shall install a magnehelic gauge for visual indication of pressure drop as well as setting and adjusting the loaded filter DP switch for monitoring on the BAS.
    b. Temporary Filtering of Water and Condensate: Construction strainers shall be used while circulating fluid during construction. Construction strainer shall be finer than that specified for final strainers.
    c. Sealing/Filtering of Open Ducts: Address that all open ducts shall be either sealed or protected with filter media. Return or exhaust systems shall not be used during construction unless otherwise approved.
    d. Lubrication and Maintenance: Contractor shall maintain the systems and equipment in accordance with the manufacturer’s instructions. Contractor shall coordinate lubricants used with Owner’s operators. Frequency of lubrication and inspection shall be as recommended by manufacturer’s literature. Applicable maintenance lubrication schedules shall be included in the Plan. Draft

maintenance logs shall be submitted with Plan and completed as maintenance is performed.

e. Operation Outside of Normal Ranges: Systems and equipment shall not be operated outside the range of specified conditions. The Temporary Conditioning Plan shall address how the Contractor will ensure that operation will not harm the equipment.

f. Emergency Condition Identification and Response Protocols: The Temporary Conditioning Plan shall address protocols for responding to equipment malfunctions and or harmful operation. Automatic safeties and remote enunciation shall be in place to protect people and property. Temporary operation shall not be allowed until there is an automatic communication/enunciation medium such as a phone connection or an Internet connection. At a minimum, an alarm on the equipment used for temporary service shall be automatically sent to the Contractor's 24-hour monitoring service and to the Owners help desk. The Contractor shall respond to and be responsible for securing conditions within the building. Owner shall assess the situation and as necessary secure utilities feeding the building from isolation points outside of the building.

3. Campus Utility Impact: The Temporary Conditioning Plan shall address the expected impact on the campus utilities involved in the temporary conditioning equipment. Specifically address:

   a. How the systems will be controlled to both ensure they are operating in range, and to avoid energy waste or inefficient conditions.
   b. Project the range of loads and flows to be imposed on the campus systems. For cooling, indicated how you will ensure a temperature split of at least 12°F.
   c. For campus chilled water connections, the bridge connection and automatic control of the bridge-related sequences shall be installed, functional and tested.

4. Building Protection: Address how the system will be controlled to avoid humidity conditions that could either promote mold growth or cause corrosion or damage.
5. Equipment Reconditioning: Address with specific means and methods how the equipment used for temporary conditioning will be reconditioned to like-new condition. Belts, seals, bearings, couplings, or other parts that wear more than 3% of their expected life shall be replaced.
6. Cleaning: Address how ducts, pipes, coils, converters, air handling equipment, terminal units, etc. shall be cleaned prior to Turn-Over.
7. Operations Log: Contractor responsible for operating the equipment shall maintain a log of all activities associated with operating and maintaining equipment. Log shall be submitted to Owner on a frequency specified by the Owner.
8. Operating System Alterations: The Temporary Conditioning Plan shall address specific protocol for doing work on the systems.
9. Damages: Any material, device, component, or equipment that is assessed as damaged or as having a substantially shortened life as a result of temporary conditioning operation shall be replaced by the Contractor at no cost to the Owner or to the project.
10. Segregation: Where only portions of a system are to be used, Contractor shall specifically indicate how the used portion will be isolated from the unused portion. The Temporary Conditioning Plan shall address how to ensure that the reduced operation condition will be maintained within acceptable ranges, and/or how capacity will be throttled to keep all operating parameters in recommended ranges.

1.17 TRAINING EVENTS AND TRAINING PLAN

A. Contractors, subcontractor, vendors, and other applicable Parties shall prepare and conduct training sessions on the installed systems and equipment they are responsible for per the requirements of Section 019100 and the individual Specifications.

1.18 SYSTEMS MANUAL AND O&M DOCUMENTATION CONTENT

A. Refer to Section 019100.

1.19 BAS TRENDING REQUIREMENTS

A. The BAS and BAS Sub-System Contractors shall configure and analyze all trends required under Division 25.

1.20 FUNCTIONAL PERFORMANCE TESTING.

A. Contractor shall participate in the initial samples of Functional Performance Testing as stipulated in Section 019100.

1.21 FPT ACCEPTANCE CRITERIA

A. Acceptance criteria for tests are indicated in Section 019100 and in the specification Sections applicable to the systems being tested. Unless indicated otherwise, the criteria for acceptance will typically be that specified with the individual system, equipment, component, or device.

PART 2 - PRODUCTS

2.01 INSTRUMENTATION

A. General: All testing equipment used by any Party shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:

1. Temperature sensors and digital thermometers shall have a certified calibration within the past year and a resolution of +/- 0.1F.
2. Pressure sensors shall have an accuracy of +/- 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.
3. All equipment shall be calibrated per the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.

B. Standard Testing Instrumentation: Standard instrumentation used for testing air and water flows, temperatures, humidity, noise levels, amperage, voltage, and pressure differential in air and water systems related to functional testing shall be provided by CA.

C. Special Tools: Special equipment, tools, and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, per these Contract Documents shall be included in the base bid price to the Contractor and turned over to the Owner upon project completion.

2.02 TEST KITS FOR METERS AND GAUGES

A. Test kits for meters and gages shall be provided to the Owner new and in good condition. Previously used kits will be unacceptable. Kits shall be submitted prior to the Acceptance Phase. Kits included shall be as a minimum:

1. Digital indication of temperature and pressure with associated sensors to work with the P/T test ports.
2. Companion readout kit (with fittings) for calibrated balancing valve with ranges as required by all devices on this project.

PART 3 - EXECUTION

3.01 GENERAL STARTUP DOCUMENTATION

A. This Section outlines 'generic' or minimally acceptable Startup Documentation (which are defined to include both 'Startup Checks' and 'Startup Tests') and individual systems training requirements for systems and equipment. These procedures are the direct responsibility of the Contractor as a basic element of validating that the installation is correct per normal quality control practices. These items shall provide a minimally acceptable guideline for required Contractor development of Startup Documentation. Contractor shall synthesize these minimum requirements along with their own internal quality control practices, those of the manufacturer, and any applicable codes and standards to develop specific and itemized final Startup Documentation specific to the equipment and systems installed on this project.

B. Section 019100 defines the systems and equipment Startup process in detail and provides definitions for Startup Documentation, including the generic Startup Documentation provided below.

3.02 STARTUP DOCUMENTATION COMMON TO ALL SYSTEMS

A. The following Startup Documentation (Checklists and Tests) shall be considered common to all systems:

1. Checkout shall proceed from lower level devices to larger components to the entire system operation.
2. Verify labeling is affixed per specification and visible.
3. Verify prerequisite procedures are done.
4. Inspect for damage and ensure none is present.
5. Verify system is installed per the manufacturer's recommendations.
6. Verify system has undergone Startup per the manufacturer's recommendations.
7. Verify that access is provided for inspection, operation, and repair.
8. Verify that access is provided for eventual replacement of the equipment.
9. Verify that record drawings, submittal data and O&M documentation accurately reflect the installed systems.
10. Verify all gauges and test ports are provided as required by contract documents and manufacturer's recommendations.
11. Verify all recorded nameplate data is accurate.
12. Verify that the installation ensures safe operation and maintenance.
13. Verify specified replacement material/attic stock has been provided as required by the Contract Documents.
14. Verify all rotating and moving parts are properly lubricated.

15. Verify all monitoring and ensure all alarms are active and set per Owner’s requirements.
16. Complete all nameplate data and confirm that ratings conform to the design documents.

3.03 VALVES

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Startup Checks: Perform the following checks during startup and as specified in manufacturer's instructions:

1. Operate all valves, manual and automatic, through their full stroke. Ensure smooth operation through full stroke and appropriate sealing or shutoff.
2. Verify actuators are properly installed with adequate clearance.
3. Verify all valves are labeled per the construction documents. Confirm that concealed valves are indicated on the finished building surface.
4. For automatic pneumatically operated valves, verify spring range and adjust pilot positioners where applicable.
5. For electronically operated valves, check the stroke and range.
6. For all automated valves controlled by a program, ensure that the minimum and maximum stroke and ranges on the valves are coordinated with the limits entered in the program.

3.04 METERS AND GAUGES

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Startup Checks: Perform the following checks during startup and as specified in manufacturer's instructions:

1. Adjust faces of meters and gauges to proper angle for best visibility.
2. Clean windows of meters and gauges and factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touch-up paint.
3. For meters and gauges requiring temporary manual connection of read-out device such as pressure taps on a flow measuring device, ensure threads are clean and that connection can be made easily.
4. Meters and gauges requiring manual connection of readout device shall be installed with adequate access to allow connection of device with normal tools.

3.05 MECHANICAL IDENTIFICATION

A. Startup Checks: Perform the following checks:

1. Verify all valve tags, piping, duct, and equipment labeling corresponds with drawings and indexes and meets requirements specified. Correct any deficiencies for all piping and duct systems.
2. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.
3. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.06 MECHANICAL INSULATION

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Startup Checks: Examine all piping, systems and equipment specified to be insulated.

1. Ensure quality of insulation. Patch and repair all insulation damaged after installation.
2. Ensure the integrity of vapor barrier around all cold surfaces.

3.07 ALL PIPING

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Startup Checks: These procedures apply to all installed piping systems, including underground site utilities.

1. Inspect all piping for proper installation, adequate support (with appropriate vibration isolation where applicable) and adequate isolation valves for required service.
2. Submit welding certifications as required by the applicable specification section or referenced ASME specification.
3. Submit certified welding inspection results per the applicable specification section or referenced ASME specification. ASME B31.1 requires 100% inspection based on pressure class.
4. Provide notification of pipe cleaning and flushing activities.
5. Flush and clean all piping and clean all strainers. Provide documentation of all related procedures.
6. Ensure adequate drainage is provided at low points and venting is provided at high points.
7. Ensure facilities to effectively drain and fill the system are in place.
8. Ensure air is thoroughly removed from the system as applicable.
9. Ensure all piping is adequately supported and anchored to allow expansion. Bump across-the- line pumps and inspect for excessive pipe movement.
10. Provide notification of pressure testing.
11. Pressure and/or leak test all applicable systems in accordance with the requirements in the applicable sections, ASME B 31.1 and 39.1 as applicable.
12. Sterilize applicable piping systems as specified in the individual Sections and as required by regulatory authorities.
13. Submit pressure test reports that document the pressure testing results with certification of the results.
14. Verify the operation of applicable safety relief valves, operating controls, safety controls, etc. to ensure a safe installation.
15. Set and adjust fill, pressure, or level controls to the required setting.

3.08 AC MOTORS

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Startup Checks: Perform the following checks during startup and as specified in manufacturer's instructions:

1. Verify proper alignment, installation, and rotation.

2. Verify properly sized overloads are in place.

C. Startup Tests: Perform the following tests, measurements, or procedures during startup and as specified in manufacturer's instructions:

1. Measure insulation resistance, phase balance, and resistance to ground.
2. Measure voltage available to all phases. Measure amps and RPM after motor has been placed in operation and is under load.
3. Record all motor nameplate data.

3.09 BEARINGS

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Startup Checks: Perform the following checks during startup and as specified in manufacturer's instructions. This applies to all bearings on fans, pumps, compressors, and other equipment installed under this Division.

1. Check alignment as applicable.
2. Lubricate all bearings per the manufacturer’s instructions. When bearing is used for temporary conditioning, lubricate on manufacturer’s recommended frequency and document it.

C. Startup Tests: Perform the following tests, measurements, or procedures during startup and as specified in manufacturer's instructions:

1. Use infrared thermometer to measure temperature at peak conditions. Ensure temperature is below manufacturer’s recommendations.
2. For bearings in drives with motors over 10 HP, use a vibration meter and measure the maximum peak-to-peak acceleration. Compare it to the Vibration Severity Chart. Rectify any condition causing severity indicated as “Rough” or worse.

3.10 VARIABLE SPEED DRIVES

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. General: Provide the services of a factory authorized service representative to test and inspect unit installation, provide startup service, and to demonstrate and train Owner's maintenance personnel as specified below.

C. Startup Checks: Perform the following checks during startup and as specified in manufacturer's instructions:

1. Check unit for shipping damage.
2. Perform a point-to-point continuity test for all field installed wiring interconnections. Verify terminations of field-installed wiring.
3. Check for proper torque on connections.
4. Verify use of shielded cable where specified and check that shields have been terminated properly.
5. Verify grounding.
6. Check motor nameplate against drive input rating.

7. Manually rotate motor shaft to ensure free rotation.
8. Check that motor leads are not grounded.

D. Startup Tests: Perform the following tests, measurements, or procedures during startup and as specified in manufacturer's instructions. Ensure device and system which drive is serving is configured to withstand the device operation specified below.

1. Adjust the 'Minimum Voltage Adjustment' to enable starting but not to draw excessive power at start.
2. Adjust the 'Volts/Hz Adjustment' to proper setting.
3. Adjust the 'Acceleration and Deceleration Rates' to the specified times.
4. Adjust 'Current Limiting' to coordinate with the overcorrect device and protect the motor.
5. Set the 'Maximum and Minimum Speed' points.
6. Manually ramp fan speed from minimum to maximum and check for excessive noise and vibration.
7. Determine any critical speeds to avoid and set these in the drive.
8. Check for acceptable voltage and current distortion on the power system. Record the input and output voltages and currents showing the harmonic content as a percentage of the base frequency.
9. Measure and record overall efficiency at 50%, 75%, and 100%.
10. Record the motor terminal voltage.

E. Training: Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventative maintenance. Review data in manufacturer's Operation and Maintenance Manuals.

3.11 HYDRONIC PIPING

A. Include all applicable 'Startup Checks Common to All Systems". Additional Startup Checks and Tests are as follows.

B. Startup Checks: Perform the following checks during startup:

1. Prepare hydronic and test piping in accordance with applicable Section and ASME B 31.9 and/or B 31.1.
2. Flush system with clean water in accordance with applicable Section.
3. Clean strainers.
4. Check expansion tanks to determine that they are not air-bound and that the system is completely full of water.
5. Set automatic fill valves for required system pressure.
6. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or to bleed air completely (manual type).
7. Set and coordinate automatic fill pressure and relief valve settings.

C. Startup Tests: Perform the following tests, measurements, or procedures during startup:

1. Chemical Treatment: Provide a water analysis prepared by the chemical treatment supplier to determine the type and level of chemicals required for prevention of scale and corrosion. Perform initial treatment after completion of system testing.

3.12 REFRIGERANT PIPING

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Startup Checks: Perform the following checks during startup:

1. Chemical Treatment: Provide a water analysis prepared by the chemical treatment supplier to determine the type and level of chemicals required for prevention of scale and corrosion. Perform initial treatment after completion of system testing.
2. Inspect, test, and perform corrective action of refrigerant piping in accordance with ASME Code B31.5, Chapter VI.
3. Verify actual evaporator applications and operating conditions, and adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.
4. Clean and inspect refrigerant piping systems in accordance with the applicable section.
5. Adjust controls and safeties. Replace damaged or malfunctioning controls and equipment with new materials and products.

C. Training: Train Owner's maintenance personnel on procedures and schedules related to startup and shut-down, troubleshooting, servicing, and preventative maintenance of refrigerant piping valves and refrigerant piping specialties.

3.13 PUMPS

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Refer to ‘AC Motors’ in this Section.

C. Refer to ‘Bearings’ in this Section.

D. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for detailed requirements for testing, adjusting, and balancing hydronic systems.

E. Startup Checks: Perform the following checks during startup:

1. Check suction lines connections for tightness to avoid drawing air into the pump.
2. Clean and lubricate all bearings.
3. Check motor for proper rotation. Rotation shall match direction of rotation marked on pump casing.
4. Check that pump is free to rotate by hand. For pumps handling hot liquids, pump shall be free to rotate with the pump hot and cold. If the pump is bound or even drags slightly, do not operate the pump until the cause of the trouble is determined and corrected.
5. Clean associated strainers.
6. Check that the proper overloads have been installed in the starter and are the correct size.
7. Verify that the integrity of the vibration isolation is maintained throughout the support and the connections.
8. Align pump within manufacturers recommended tolerances.
9. Ensure all associated piping has been cleaned, tested, and deaerated.
10. Verify that all thermometers and gauges are installed, are clean and undamaged, and are functional.

F. Startup Tests: Perform the following tests, measurements, or procedures during startup:

1. Start the pump per the manufacturer’s instructions.
2. Check the general mechanical operation of the pump and motor.
3. Verify that check-valve seal is appropriate.
4. Check noise and vibration levels and ensure they are within the manufacturer’s recommended tolerances.
5. Check that the NPSH is with that allowable for the operating condition.
6. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for detailed requirements for testing, adjusting, and balancing hydronic systems.

3.14 GAS-FIRED BOILERS

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Refer to AC Motors in this section.

C. Startup Checks: Perform the following checks during startup:

1. All associated piping has been cleaned, tested, filled, and deaerated.
2. Flue(s) are installed correctly.
3. Ensure cast-iron boilers are flushed and cleaned upon completion of installation, in accordance with manufacturer's startup instructions.
4. Ensure hydrostatic tests on assembled boiler and piping were performed and documented in accordance with applicable sections of ASME Boiler and Pressure Vessel Code.
5. Arrange with National Board of Boiler and Pressure Vessel Inspectors for inspection of boiler piping, observation of hydrostatic testing, and for certification of completed boiler units.

D. Startup Tests:

1. Arrange and pay for a factory-authorized service representative to:

a. Inspect the installation and access/clearance for service and maintenance to ensure it meets the project and manufacturer’s requirements.
b. Check for adequate fuel line pressures throughout operational range.
c. Test and adjust operating and safety controls.
d. Adjust burner for maximum burning efficiency throughout the range of fire.
e. Ensure adequate draft in the flue throughout firing range with various combinations of multiple boilers.

E. Efficiency Test: Provide the service of an independent testing agency to test the efficiency in accordance with the ASME Boiler and Pressure Vessel Code (short form).

3.15 BOILER ACCESSORIES

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Startup Tests: Perform the following before or during startup:

1. Flush and clean all boiler accessories upon completion of installation, and in accordance with manufacturer's installation instructions.

2. Hydrostatically test, if required, and assemble boiler accessories and piping in accordance with applicable sections of ASME Boiler and Pressure Vessel Code.
3. Operate all safeties and control interlocks and to ensure proper operation and adjustment.

3.16 BREECHINGS, CHIMNEYS, AND STACKS

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Startup Checks: Perform the following checks during startup:

1. Clean breechings internally during installation to remove dust and debris.
2. Clean external surfaces to remove welding slag and mill film.
3. Grind welds smooth.
4. Check to ensure adequate draft throughout firing range and with all variations of multiple boilers.

3.17 AIR-COOLED CONDENSING UNITS

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. General: Provide the services of a factory-authorized service representative to test and inspect unit installation, provide startup service, and to demonstrate and train Owner’s maintenance personnel as specified below.

C. Refer to AC Motors in this section.

D. Startup Checks: Perform the following inspections/checks during startup:

1. Ensure unit is level.
2. Coils are undamaged and fins are combed.
3. Fans rotate freely and in the proper direction.

E. Startup Tests: Perform the following during startup:

1. Startup condensing units in accordance with manufacturer's startup instructions.
2. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
3. Leak test field assemble refrigerant systems with dry nitrogen. Test for leaks and repair. Evacuate to required levels for the required time period and then charge refrigerant systems with refrigerant and oil, and recheck for leaks. Repair leaks and replace lost refrigerant and oil.
4. Flush clean and leak test glycol systems per the procedures for hydronic systems. Charge glycol systems with the specified type and concentration of glycol and recheck for leaks. Repair any leaks and replace lost glycol.

F. Training: Factory-authorized representative shall train Owner's maintenance personnel including:

1. Procedures and schedules related to startup and shut down, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
2. Familiarization with contents of manufacturer’s Operating and Maintenance Manuals.

3.18 AIR-COOLED CHILLERS

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. General: Provide the services of a factory-authorized service representative to test and inspect unit installation, provide startup service, and to demonstrate and train Owner's maintenance personnel as specified below. Representative shall provide a written report documenting the Startup.

C. Refer to Bearings in this Section.

D. Startup Checks: Perform the following inspections/checks during startup:

1. Ensure that all associated piping is cleaned, tested, filled, and deaerated.
2. Inspect the installation and access/clearance for service and maintenance to ensure it meets the project and manufacturer’s requirements.
3. Check control interfaces for proper ranges and approve the interface.

E. Startup Test and Service:

1. Provide the services of a factory-authorized service representative to provide startup service.
2. Evacuate, dehydrate, vacuum pump and charge with specified refrigerant, and leak test in accordance with manufacturer's instructions. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
3. Perform lubrication service, including filling of reservoirs, and confirming that lubricant is of quantity and type recommended by manufacturer.
4. Optimize chiller charge and operating characteristics.
5. Log machine parameters at various load, at a minimum 25%, 50%, 75%, and 100%.
6. Confirm chiller cycles are within manufacturer’s recommendations and that compressors generally do not start more than 6 times per hour.
7. Submit factory startup report per specifications.

F. Training: Factory-authorized representative shall train Owner's maintenance personnel including:

1. Procedures and schedules related to startup and shut down, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
2. Familiarization with contents of Operating and Maintenance Manuals.

3.19 PACKAGED HEATING AND COOLING UNITS

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. General: Provide the services of a factory-authorized service representative to test and inspect unit installation, provide startup service, and to demonstrate and train Owner's maintenance personnel as specified below.

C. Refer to AC Motors in this section.

D. Startup Checks: Perform the following inspections/checks during startup:

1. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

2. Install new filters after startup.

E. Training: Factory-authorized representative shall train Owner's maintenance personnel including:

1. Procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
2. Familiarization with contents of Operating and Maintenance Manuals.

3.20 CENTRAL-STATION AIR HANDLING UNITS

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. General: Provide the services of a factory-authorized service representative to test and inspect unit installation, provide startup service, and to demonstrate and train Owner's maintenance personnel as specified below.

C. References: The following additional Sections shall also apply:

1. Refer to AC Motors in this Section.
2. Refer to Fans in this Section.
3. Refer to Bearings in this Section.
4. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.
5. Refer to Section 250800 - BAS Commissioning for procedures for starting the controls related to the AHU.

D. Startup Checks: Perform the following inspections/checks during startup:

1. Inspect the field assembly of components and installation of central-station air-handling units including piping, ductwork, and electrical connections.
2. Cleaning: Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel, fan cabinet, and coils entering air face. Ensure volatile irritants are contained and kept out of occupied spaces.
3. Adjust and lubricate dampers and linkages for proper damper operation.
4. For field-fabricated units, ensure the sections are properly connected within acceptable tolerances.
5. Seal all penetrations to be air-tight and ensure access doors seat tightly.
6. Verify that unit is secure on mountings and supporting devices and connections for piping, ductwork, and electrical are complete.
7. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
8. Ensure vibration isolation integrity is maintained throughout the AHU installation and its connections.
9. Tension all belts per the drive manufacturer’s recommendations.
10. Disconnect fan drive from motor and verify proper motor rotation direction and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
11. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
12. Comb coil fins for parallel orientation.
13. Install clean filters.
14. Ensure condensate drains properly and that trap is adequate.
15. Stroke all valves and damper to ensure free and full travel.

E. Startup Tests: Perform the following during startup:

1. Pressure test units as required in the AHU specification.

F. Training: Factory-authorized representative shall train Owner's maintenance personnel including:

1. Procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
2. Familiarization with contents of manufacturer’s Operating and Maintenance Manuals.

3.21 FANS

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. General: Provide the services of a factory-authorized service representative to test and inspect unit installation, provide startup service, and to demonstrate and train Owner's maintenance personnel as specified below.

C. References: The following additional Sections shall also apply:

1. Refer to AC Motors in this Section.
2. Refer to Bearings in this Section.
3. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.
4. Refer to Section 250800 - BAS Commissioning for procedures for starting the controls related to the fan.

D. Startup Checks: Perform the following inspections/checks during startup:

1. Inspect the field assembly of components and installation of central-station air-handling units including piping, ductwork, and electrical connections.
2. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel, fan cabinet, and coils entering air face. Ensure volatile irritants are contained and kept out of occupied spaces.
3. Adjust and lubricate dampers and linkages for proper damper operation.
4. Verify that unit is secure on mountings and supporting devices and connections for ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
5. Ensure vibration isolation integrity is maintained with the fan installation and associated connections.
6. Disconnect fan drive from motor and verify proper motor rotation direction and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
7. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
8. Stroke all dampers to ensure free and full travel.

E. Training: Factory-authorized representative shall train Owner's maintenance personnel including:

1. Procedures and schedules related to startup and shut down, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
2. Familiarization with contents of manufacturer’s Operating and Maintenance Manuals.

3.22 AIR CLEANING AND FILTERS

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. General: Operate installed air filters to demonstrate compliance with requirements. Test for air leakage of unfiltered air while system is operating. Correct malfunctioning units at site, then retest to demonstrate compliance; otherwise remove and replace with new units, and proceed with re-testing.

3.23 METAL DUCTWORK

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure using polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

C. Startup Checks: Perform the following checks during startup and as specified:

1. Clean ductwork internally of dust and debris, unit-by-unit as it is installed. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.
2. Strip protective paper from stainless ductwork surfaces if applicable, and repair finish wherever it has been damaged.

D. Startup Tests: In addition to specifications, perform the following as a minimum:

1. Leakage Tests: After each duct system is completed, test for duct leakage in accordance with SMACNA HVAC Air Duct Leakage Test Manual. Repair leaks and repeat tests until total leakage is less than 1% of system design air flow.
2. Balancing: Refer to Division-23 section "Testing, Adjusting, and Balancing" for air distribution balancing of metal ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.

3.24 DUCTWORK ACCESSORIES

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Startup Checks: Perform the following checks during startup and as specified:

1. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

C. Startup Tests: In addition to specifications, perform the following as a minimum:

1. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leak proof performance.
2. Label access doors in accordance with Division 23 Section "Mechanical Identification".

3. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.
4. Final positioning of manual dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing".
5. Fire Damper Testing: For every fire damper, remove the fusible link and verify that the damper operates freely and closes tightly. Reinstall the fusible link.

3.25 BUILDING AUTOMATION SYSTEM AND CONTROL SUB-SYSTEMS

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Startup Checks: Perform the following checks during startup and as specified:

1. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

C. Startup Tests: Refer to Section 250800 – BAS Commissioning. This requires manufacturers authorized representative to startup, test, adjust, and calibrate direct digital and other microprocessor-based control systems and demonstrate compliance with requirements. This will include verification of sequences, normal and emergency operations, calibration, interfaces, and interlocks, etc.

3.26 TESTING, ADJUSTING, AND BALANCING

A. Reference: Perform testing, adjusting, and balancing (TAB) procedures on each system identified, in accordance with the detailed procedures outlined in the respective section and the referenced standards.

B. Startup Checks: In addition to specifications, perform the following as a minimum:

1. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.
2. Patch insulation, ductwork, and housings, using materials identical to those removed.
3. Seal ducts and piping, and test for and repair leaks.
4. Seal insulation to re-establish integrity of the vapor barrier.
5. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.
6. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.
7. Test and adjust mechanical systems for sound and vibration in accordance with the detailed instructions of the referenced standards.

C. Training:

1. Train the Owner's maintenance personnel on troubleshooting procedures and on testing, adjusting, and balancing procedures.
2. Review for the Owner’s personnel the locations of TAB reports and data.

3.27 HEAT TRACING

A. Include all applicable ‘Startup Checks Common to All Systems”. Additional Startup Checks and Tests are as follows.

B. Electrician shall measure insulation resistance of heater with 1000 volt DC megohmmeter (megger) after the plumber has attached heater to pipe and before thermal insulation has been installed. Insulation resistance, measured between braid and either bus wire, should be at least 20 megohms regardless of heater length. Record these readings for each circuit.

C. Contractor shall test continuity of both heater bus wires to verify connection of splices or tees.

D. Megger heater after thermal insulation has been installed and record readings. Insulation resistance should be at least 20 megohms when measured at 1000 volts DC.

E. If heater circuit fails either insulation resistance test or continuity test, electrician shall notify Mechanical Contractor. Mechanical Contractor must repair or replace circuits yielding unacceptable readings. Megger tests must be witnessed by Construction Manager and manufacturer's representative. Copy of test report shall be submitted to engineer. Manufacturer's representative shall retain one copy for their file and mail copy to factory for record.

3.28 WORK SEQUENCE ILLUSTRATION

A. Reference Section 019100.

3.29 TRAINING

A. System training requirements are detailed in 019100.

END OF SECTION 230800

SECTION 23 01 00 MECHANICAL GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions, DIVISION 1 - GENERAL REQUIREMENTS, apply to the work specified in this Division, with additions and modifications specified herein.

1.2 APPLICATION: This section applies to all Sections of 22 and 23 - Mechanical Work of these specifications, including modifications and additions specified in each individual section.

1.3 DESCRIPTIONS OF WORK:

A. Scope: The work covered by this Division of these Specifications consist of furnishing all plant, labor, equipment, appliances, and materials, and in performing all operations in connection with the mechanical work, including all items of special equipment specified herein, complete in strict accordance with this Division of these Specifications and the applicable Drawings.

B. Work Included: The work involves a complete mechanical system. Generally the work includes, but is not limited to the following items. Complete heating, ventilating and air conditioning system.

Complete heating, ventilating and air conditioning system

Hot and chilled water distribution system, including pumps, piping, etc.

Domestic hot and cold water distribution system.

Waste and drainage system.

Plumbing fixtures, appliances, equipment, and specialties.

Temperature control system and Instrumentation.

Terminal and acoustical insulation.

Mechanical rough-in and mechanical connection of equipment furnished under other Divisions of this Contract.

Maintain a clean work area.

Testing, adjusting and balancing of the mechanical system.

Equipment and piping identifications.

Miscellaneous other work for a complete and operative mechanical system.

Structural steel for equipment supports.

1.4 Related Work Specified Elsewhere: Generally the following work is specified under other Sections of the project Specifications.

A. Electrical power wiring and power connection to equipment.

B. All painting except restoring finish on equipment that has sustained damage during shipment or installation.

C. Receiving, uncrating and installing equipment furnished by others or the Owner.

1.5 SITE CONDITIONS: Before submitting a proposal for the work contemplated in these Specifications and accompanying Drawings, each bidder shall examine the site and

familiarize himself with all the existing conditions and limitations. No extras will be allowed because of the Contractor's misunderstandings as to the amount of work involved or his lack of knowledge of any condition in connection with the work.

1.6 FEES, PERMITS AND INSPECTIONS: This Contractor shall secure and pay all fees, permits and inspections required on work performed under this section of the contract Specifications. Fees shall include, but not limited to, sewer, water and/or gas taps and all gas/ water meter fees charged by the utility companies. He shall assume full responsibility for all assessments and taxes necessary for completion and acceptance of this work.

1.7 APPLICABLE CODES AND STANDARDS: All materials, arrangements, and workmanship shall comply with all applicable codes, specifications, federal and state laws, local ordinances, industry standards and utility company regulations. In case of difference between building codes, Specifications, Federal and State laws, local ordinances, standards and utility company regulations and the Contract Documents, the most stringent requirement shall govern. The Contractor shall promptly notify the Architect in writing of such difference. Should the Contractor perform any work that does not comply with requirements of the applicable building codes, Federal and State laws, local ordinances, industry standards, and utility company regulations, he shall bear all costs arising in correcting the deficiencies. Applicable Codes and Standards shall include all state laws, State Board Health and State Rating Bureau, local ordinances, industry standards, and utility company regulations. Comply with applicable requirements of the following national accepted codes and standards as though they were copied herein fully:

ARI	Air Conditioning and Refrigeration Institute
ADC	Air Diffusion Council
AMCA	Air Moving & Control Association
AABC	American Air Balance Council
AGA	American Gas Association
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigeration & Air Conditioning Engineers Handbook
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society of Testing Materials
AWS	American Welding Society
AWWA	American Water Works Association
CISPI	Cast-Iron Soil Pipe Institute
CTI	Cooling Tower Institute
FM	Factory Mutual System
HI	Hydronic Institute
IBC	International Building Code
IEEE	Institute of Electrical and Electronic Engineers
IPC	International Plumbing Code
MSS	Manufacturer's Standardization Society
MPTA	Mechanical Power Transmission Association
NBS	National Bureau of Standards
NEMA	National Electrical Manufacturers Association

NEBB	National Environmental Balancing Bureau
NFPA	National Fire Protection Association - Fire Codes
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Act Standards
PDI	Plumbing and Drainage Institute
SMACNA	Sheet Metal & Air Conditioning Contractors National Association
SAE	Society of Automotive Engineers
UL	Underwriters' Laboratories

1.8 APPROVAL OF MATERIALS AND EQUIPMENT:

A. Quality Standards: Whenever a material, article or piece of equipment is identified on the Drawings or in the Specifications by reference to manufacturers' or vendors' names, trade names, catalog numbers, or the like, it is so identified for the purpose of establishing a standard of quality and shall not be construed as limiting competition. Any material, article or piece of equipment of other manufacturers or vendors which will perform adequately the duties impose by the design will be considered equally acceptable provided the material, article, or piece of equipment so proposed is, in the opinion of the Architect, of equal substance, appearance and function. It shall not be purchased or installed by the Contractor without the Architect's written approval. In order that all bidders, manufacturers, and vendors receive fair and equal consideration, the procedures described hereinafter shall be complied with.

B. Approval of Substitutions: Prior written approval by the Architect/Engineer is required for substitutions for all materials, articles and equipment specified without qualifications or followed by "or prior approved equal". Request for prior approval shall be submitted to the Architect, with copy to Engineer, at least ten (10) days before time of bid opening. Approved substitutions will be included in an addendum to the Specification or in writing at the discretion of the Architect. Request for approval for materials, articles, and equipment qualified with "equal to" or "or equal" shall be submitted within 30 days after award of contract but before purchase. IN CONNECTION WITH THE USE OF ANY ALTERNATE ITEM APPROVED BY THE ARCHITECT, IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO SEE THAT SUCH ITEMS MEET ALL REQUIREMENTS, AND THAT ANY ALTERATIONS TO CONNECTING OR ASSOCIATED ITEMS NECESSITATED BY USE OF THE ALTERNATE ITEMS ARE PROPERLY MADE WITHOUT ADDITIONAL COSTS TO THE OWNER. This includes but is not limited to added breakers, fuses, disconnects, wiring, or piping that is not indicated by scheduled equipment. Architect's opinion shall be final on quality of substituted items.

C. Manufacturer's Brochures and Shop Drawings: As soon as practicable after award of the contract and before starting installation of any materials or equipment, the Contractor shall submit to the Architect for approval six (6) copies of Manufacturer's brochures and shop Drawings giving rating, operating characteristics, wiring diagrams, power requirements, etc., of the material and equipment proposed for installation. A complete electrical connection diagram for each electrically controlled component shall be submitted for approval. The connection diagram shall identify each component and shall show all interconnected and interlocked components. Automatic temperature control

diagrams shall be submitted. All data submitted shall be sufficiently complete to demonstrate conformance with the Specification requirements. Drawings showing all ducts, piping and installation details shall be submitted for approval with Material and Equipment submittal if equipment is different from that indicated on the Drawings. Checking and approval of brochures and shop Drawings by the Architect shall not relieve the Contractor from the responsibility for deviations from the Drawings and Specifications unless he has in writing called the Architect's attention to such deviations at time of submission and secured his written approval, nor shall it relieve him of responsibility for errors or omissions in the shop Drawings. Checking and approval by the Architect is only for general conformance with design intent and contract requirements. It is the Contractor's responsibility to verify the accuracy of dimensions, obtaining field dimensions, by comparison and measurements in the field. Final shop Drawings shall indicate field verified dimensions.

1.9 DEVIATIONS:

A. Drawings: The Mechanical Drawings show the general arrangement of all piping, equipment, and appurtenances and shall be followed as closely as actual building construction and the work of other trades will permit. The mechanical work shall conform to the requirements shown on all of the Drawings. General and Structural Drawings shall take precedence over Mechanical Drawings. Because of the small scale of the Mechanical Drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, valves and accessories as maybe required to meet such conditions. If major departures from the contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted as soon as practicable for approval. No major departures shall be made without prior written approval.

B. Space Conditions: Every attempt has been made to design the systems so as to cover the installation of all equipment and connections thereto without interference to the structural design of the building. Contractor shall note that space in some locations is critical, and shall prior to installing his work coordinate the location with all other trades. If interference results from failure of the Contractor to exercise such caution, work shall be relocated as the Engineer ascertains would most facilitate job progress. Relocation shall be at the expense of the Contractor whose work is relocated, and the decision of the Engineer shall be final. If Contractor is unable to achieve desired cooperation with other trades and/or subcontractors, he is cautioned not to proceed but to inform the Engineer as to his difficulties. Contractor shall make offsets, transitions and changes in direction in pipe, ducts, etc., as required to maintain proper grades, or essential elevations.

1.10 COOPERATION: Cooperate and coordinate with others in laying out work so that this phase of the work will properly fit the building and other contractors' requirements. Priority of locations shall be as follows:

Light Fixtures

Ceiling Mounted Air Control Devices

Fire Protection System

Ductwork
Plumbing Waste, Drain and Vent System
Mechanical Equipment
Electrical Equipment
Mechanical Piping Mains
Electrical Feeders

1.11 OPERATING AND MAINTENANCE INSTRUCTIONS:

A. Bound Instructions: Four (4) complete sets of instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment shall be furnished to the Owner. Each set shall be permanently bound and shall have a hard cover. One complete set shall be furnished at the time the test procedure is submitted, and the remaining sets shall be furnished before the Contract is completed. Flysheet shall be placed before instructions covering each subject. Flysheet shall be placed before instructions covering each subject. The instructions sheets shall approximately 8-1/2" by 11" with large sheets of Drawings folded in. The instructions shall include, but shall not be limited to the following:

1. System layout showing piping, valves, and controls.
2. Approved wiring and control diagrams, with date to explain the detailed operation and control of each component.
3. A control sequence describing startup, operation and shutdown.
4. Operating and maintenance instructions for each piece of equipment, including lubrication instructions.
5. Manufacturer's bulletins, cuts and descriptive data.
6. Parts lists and recommended spare parts.

B. Framed Instructions: Approved wiring and control diagrams showing the complete layout of the entire system, including equipment, piping, valves and control sequence, framed under glass or in approved laminated plastic, shall be posted where directed. In addition, condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in type form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. Proposed diagrams, instructions and other sheets shall be submitted for approval prior to posting.

C. Field Instructions: Upon completion of the work and at a time designated, the services of one project engineer shall be provided by the Contractor to instruct the representative of the Owner in the operation and maintenance of the mechanical systems.

1.12 RECORD DRAWINGS:

A. This Contractor shall provide record Drawings at completion of job. Drawings to show all significant changes in piping, equipment, wiring, etc. The actual location of all piping drains, clean-outs, apparatus and equipment shall be indicated. These Drawings are to be turned over to the Architect at completion. All

cleanouts and concealed equipment (below grade) to be dimensioned from building lines, etc.

1.13 CONNECTION OF EQUIPMENT FIXTURES FURNISHED BY OTHERS:

A. This Contractor shall provide all necessary materials and labor to connect to the mechanical systems all equipment and fixtures having mechanical connection and which are specified in other Divisions of the project Specifications. Drainage connections shall be trapped. The supply and return lines for each item of equipment or fixture, except control valves with integral stops, shall be provided with cut-off valves to enable isolation of the item for repair and maintenance without interfering with the operation of other equipment or fixtures. Refer to other Divisions of the project Specifications for additional requirements. Actual rough-in dimensions shall be obtained from shop Drawings or measurements of the equipment or fixture.

B. The unpacking, assembling and setting of equipment furnished by the Owner or under other than Mechanical Sections of these Specifications will not be performed under this Division of the Specifications.

C. Due to the fact that the manufacture of the equipment actually purchased may vary slightly from that specified in the above lists and therefore require some rearranging of equipment different from that indicated on the Drawings, the Contractor shall make connections to such rearranged equipment without additional cost to the Owner. That is, for an initial installation arrangement other than that indicated on the Drawings. Equipment will be furnished complete with faucets, waste strainer and tailpiece. This Contractor shall supply traps, supplies, and stops for above equipment.

1.14 ELECTRICAL:

A. Refer to the Electrical Drawings and specifications for ELECTRICAL WORK, for the characteristic of the available electrical power. All motors and equipment under this contract to be compatible with the local voltages.

B. For each and every motor installed under this section of the contract, furnish to the Electrical Contractor for installation the proper motor starter, where not specified to be furnished by the electrical contractor and where required, pushbuttons or hand-off automatic controls, or other required relays or control devices. All motors which start and stop automatically or as specified, shall be furnished with magnetic starters, pushbuttons and relays as required. The Electrical Contractor will wire from service to starter to motor. Any additional secondary control circuits, such as remote control stations, and temperature control wiring shall be provided under this Division. Each and every wire in each and every junction box, starter, pull box or where else terminating or connecting or visible shall be color coded and numbered using Brady Stick-On numbers or equivalent. Upon completion of all wiring, including control and secondary wiring, Contractor shall furnish finished shop Drawing showing each wire number and connecting points for each and every unit. Contractor shall 'meg' every circuit to determine leaks or shorts and correct same before calling for inspection by Engineer.

C. All wiring installed under the responsibility of this Contractor shall be in conduit and in strict accordance with the National Electrical Code and Specifications,

ELECTRICAL WORK of the project Specifications.

1.15 WORKMANSHIP:

A. All work shall be executed in a neat and substantial manner by skilled workmen well qualified and regularly engaged in the type of work required. Substandard work shall be removed and replaced by the Contractor at no cost to the Owner.

1.16 CUTTING AND PATCHING:

A. This Contractor shall provide all cutting, digging, etc., incident to his work and shall make all required repairs thereafter to the satisfaction of the Architect, but in no case shall the Contractor cut into any major structural element beam or column without written approval of the Architect. Pavements, sidewalks, roads, curbs, walls, ceilings, floors and roofs shall be cut, patched, repaired and/or replaced as required to permit the installation of the work and such cutting, patching, repairing, and replacing shall be the responsibility of and paid for by the Contractor under this section of the Specifications.

B. The Contractor shall bear the expense of all cutting, painting, patching, repairing or replacing of the work of other trades required because of his fault, error or tardiness or because of any damage done by him.

1.17 CLEANING AND PAINTING:

A. The respective Contractors or Sub-contractors for the various phases of the work shall clear away all debris, surplus materials, etc., resulting from their work or operations, leaving the job and equipment furnished under any or all Contracts in a clean first class condition.

B. All plumbing fixtures shall be thoroughly cleaned of all plaster, stickers, rust stains and other foreign matter or discoloration, leaving every part in an acceptable condition and ready for use. The surfaces of all pumps, motors, floor drains, cleanouts and other equipment shall be cleaned and each item shall be left in a first class condition.

C. Painting of materials and equipment furnished under the mechanical portion of the Contract is specified under the General Construction Contract as described in other Sections. The Mechanical Contractor shall, however, refinish and restore to the original conditions and appearance, all mechanical equipment which has sustained damage to manufacturer's prime and finish coats of enamel or paint. Materials and workmanship shall be equal to the requirements described for other painting.

1.18 EQUIPMENT SAFETY: Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, rotating parts, and other power transmission apparatus, located so that any person can come in close proximity thereto, shall be fully enclosed or properly guarded in accordance with OSHA 1910.219. Provide positive means of locking out equipment so that it cannot be accidentally started during maintenance procedures. High-temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type as specified. Ensure that access openings leading to equipment are large enough to carry through routine maintenance items such as filters and tools.

1.19 DELIVERY AND STORAGE: Equipment and materials shall be handled, stored, and

protected to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Architect/Engineer. Damaged or defective items shall be replaced.

1.20 STANDARD PRODUCTS/SERVICE AVAILABILITY:

A. Materials and Equipment: Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two-year use shall include applications of equipment and materials under similar circumstances and of similar size.

B. Experience Required: The two-year experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures.

C. Service Support: The equipment items shall be supported by service organizations. The Contractor shall submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

D. Manufacturer's Nameplate: Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.21 EXISTING UTILITIES, STRUCTURES AND OTHER PROPERTY: Prior to any excavation, it shall be the responsibility of the Contractor to locate and avoid damage to any and all existing water, gas, sewer, electric, telephone and all other underground utilities or structures. The Contractor shall contact the various local utility departments or other responsible agencies and obtain location Drawings, or other assistance in the locations of existing underground work. The Contractor shall repair or pay for all damage caused by his operations to all existing property, public or private, whether it is below or above ground, and shall settle in total cost all damage suits which may arise as a result of his operations.

1.22 GUARANTEE: This Contractor shall guarantee to 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 Architect and Owner. Any defects arising during this period will be promptly remedied by the Contractor without cost to the Owner. Compressors shall have a five (5) year warranty.

PART 2 - NOT APPLICABLE

PART 3 - NOT APPLICABLE

END OF SECTION

SECTION 23 07 00 INSULATION OF MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Section 23 01 00 - Mechanical General Requirements, with modifications and additions specified herein, apply to the work specified in this Section.

1.2 SECTION INCLUDES:

A. Piping Insulation, Jackets, and Accessories.

B. Equipment Insulation and Covering.

C. Ductwork Insulation, Jackets and Lining.

1.3 QUALITY ASSURANCE:

A. Applicator: A company specializing in insulation application with three years minimum experience.

1.4 SUBMITTALS:

A. Submit product data under the provisions Section 23 01 00.

B. Include product description, list of materials and thickness for each service, equipment and location.

C. Submit manufacturer's installation instructions.

1.5 MANUFACTURER'S STAMP OR LABEL:

A. Every package of insulation, jackets, cement, adhesives, and coatings delivered to the project site must have the manufacturer's stamp or label attached giving name of manufacturer, brand, and description of material.

1.6 FLAME SPREAD AND SMOKE DEVELOPED RATINGS:

A. In accordance with NFPA 255, ASTM E 84, or UL 723, the materials shall have a flame - spread rating of not more than 25 and a smoke - developed rating of not more than 50.

B. Materials Tests: UL label or satisfactory certified test report from a testing laboratory will be required to indicate that the fire hazard ratings for the materials proposed for use do not exceed those specified. Test factory-applied materials as assembled. Field-applied materials may be tested individually. Flame-proofing treatments subject to deterioration due to effects of moisture or high humidity are not acceptable.

C. Materials Exempt From Fire-Resistant Rating: Nylon anchors and PVC fitting covers.

PART 2 - PRODUCTS

2.1 PIPING SYSTEMS INSULATION:

A. Piping systems requiring insulation, types of insulation required, and insulation thickness shall be as listed in Tables I and II herein. Insulate all fittings, flanges, and valves with factory premolded, precut, or field-fabricated insulation of the same thickness and conductivity as used on adjacent piping. Use factory premolded, precut, or field-fabricated insulation of the same thickness and conductivity as used on adjacent piping. Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling.

B. Pipe Insulation:

1. Glass Fiber Insulation: ANSI/ASTM C547; `K' value of .24 at 75 degrees F.; noncombustible.

2. Cellular Glass Insulation: ANSI/ASTM C552; maximum water vapor transmission rating of 0.1 perm; `K' value of 0.40 at 75 degrees F.

3. Flexible Unicellular Insulation: ASTM C 534. Adhesive shall be as recommended by the insulation manufacturer and applied in accordance with the manufacturer's published instructions.

C. Pipe Insulation Finishes:

1. All-Purpose Jacket: Except calcium silicate and unicellular insulation, provide a factory applied all-purpose jacket with or without integral vapor barrier as required by the service. Provide jackets in exposed locations with a white surface suitable for field painting without sizing. Allow a maximum water vapor permeance of 0.05 perm per ASTM E 96, a puncture resistance of not less than 50 Beach units, and a minimum tensile strength of 35 pounds force per inch of width in accordance with ASTM D 828.

2. Vapor Barrier Materials: Kraft reinforced foil vapor barrier with self-sealing adhesive joints. Resistant to flame, moisture penetration, and mold growth. Provide vapor-barrier materials on pipe as required in Table I.

2.2 DUCTS AND PLENUMS (HVAC) INSULATION:

A. Duct Insulation in Concealed Spaces: Insulation shall be blanket type flexible mineral fiber conforming to ASTM C 553, Type I, Class B-3, 1.0 pounds per cubic foot nominal, and 2.0 inches thick. Flexible insulation shall be used in concealed spaces only.

B. Duct Insulation Exposed in Mechanical Rooms: Insulation shall be mineral fiber board per ASTM C 612, Class 2, 6 pounds per cubic foot average density, one-inch thick.

C. Duct Insulation Finishes:

1. All-Purpose Jacket: Provide a factory applied all-purpose jacket with integral vapor barrier as required by the services. Provide jackets in exposed locations in equipment rooms with a white surface suitable for field painting without sizing.

2. Vapor Barrier Material: Scrim foil facing. Materials shall be resistant to flame,

moisture penetration, and shall not support mold growth. Provide vapor barrier on all HVAC duct insulation. All-purpose jacket shall have a maximum water vapor permeance of 0.05 perm per ASTM E 96; a puncture resistance of not less than 50 Beach units; and a tensile strength of not less than 35 pounds-force per inch width in accordance with ASTM D 828.

2.3 EQUIPMENT:

A. Insulate all equipment and accessories as specified in Table III. Increase the specified insulation thickness for equipment only where necessary to equal the thickness of angels or other structural members to make a smooth exterior surface.

2.4 ADHESIVE, SEALANTS, AND COATING COMPOUND:

A. Adhesive for Securing Insulation to Metal Surfaces and Vapor Barrier Lap Adhesive: ASTM C 916, Type I, (and adhesive in which the vehicle is nonflammable in the liquid state and which will pass the burning test).

B. Mineral Fiber Insulation Cement: ASTM C 195, thermal conductivity 0.85 maximum at 200 degrees F. mean when tested per ASTM C 177.

C. Vapor Barrier Coatings: Manufacturer's recommendation for indoor on surface temperature of 60 degrees and above, color white.

D. Flexible Unicellular Insulation Adhesive: Compatible with the Insulation.

E. Finishing Cement: ASTM C 449.

2.5 ACCESSORIES:

A. Staples: ASTM A 167, Type 304 or 316 stainless steel, outside-clinch type.

B. Insulation Bands: 3/4-inch wide: 0.20-inch aluminum.

C. Glass Cloth and Tape: Tape shall be 4-inch wide rolls, shall be 405 ounces per square yard. Open weave glass membrane may be used in lieu of glass cloth.

D. Wire: Soft annealed stainless steel, 0.047-inch nominal diameter.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Do not insulate materials until all system tests have been completed and surfaces to be insulated have been cleaned of dirt, rust, and scale and dried. Insulate return ducts, outside air intakes and supply ducts to the room outlets, exhaust ducts, flexible run outs, plenums, casings, mixing boxes, filter boxes, coils, fans, and the portion of air terminals not in the conditioned spaces. Ensure full range of motion of equipment actuators. Modify insulation to avoid obstruction with valve handle, safety relief, etc. Insulation shall be continuous through sleeves, wall and ceiling openings, except at fire dampers in duct systems. Extend all surface finishes to protect all surfaces, ends, and raw edges of insulation. Apply coatings and adhesives at the manufacturer's recommended coverage per gallon. Individually insulate piping and ductwork. Provide a

moisture and vapor seal where insulation terminates against metal hangers, anchors and other projections through the insulation on surfaces for which a vapor seal is specified. Keep insulation dry during the application of any finish. Bevel and seal the edges of exposed insulation. Unless otherwise indicated, do not insulate the following:

1. Factory pre-insulated flexible ductwork.
2. Factory insulated ductwork, plenums, casing, mixing boxes, and filter boxes.
3. Vertical portion of interior roof drain pipelines, chrome plated pipes, and fire protection pipes.
4. Vibration isolating connections.
5. Adjacent insulation.
6. ASME stamps.
7. Equipment name plates.
8. Access plates in fan housing.

3.2 PIPING INSULATION:

A. General: Insulation shall be continuous through sleeves, wall and ceiling openings. Extend all surface finishes to protect all surfaces, ends, and raw edges of insulation. Provide a moisture and vapor seal where insulation terminates against metal hangers, anchors and other projections through the insulation on surfaces for which a vapor seal is specified. Bevel and seal the edges of exposed insulation.

B. Glass Fiber and Cellular Glass Pipe Insulation: Place sections of glass fiber pipe insulation around the pipe and joints tightly butted into place. Place sections of cellular pipe insulation around pipe and joints; seal all horizontal joints, butt joints, ends, longitudinal joints, etc. with hot asphalt or Hydrocal B-11 gypsum cement. Secure jacket with fire resistant adhesive or factory applied self-sealing lap. Cover circumferential joints with butt strips, not less than 3-inches wide, of material identical to the jacket material. Overlap longitudinal laps of jacket material not less than 1-1/2 inches. When a vapor barrier jacket is required, as indicated in TABLE I, or on the ends of section of insulation that butt against flanges, unions, valves, and fittings, and joints, use a vapor-barrier coating. Apply this vapor barrier coating at all longitudinal and circumferential laps. At penetrations by pressure gauges and thermometers, fill the voids with the vapor barrier coating. Seal with a brush coat of the same coating.

C. Flexible Unicellular Insulation: Bond cuts, butt joints, ends, and longitudinal joints with adhesive. Miter 90-degree turns and elbows, tees, and valve insulation. Where pipes penetrate fire walls, provide mineral-fiber insulation inserts and sheet-metal sleeves. Insulate flanges, unions, valves, and fittings in accordance with manufacturer's published instructions. Apply two coats of vinyl lacquer finish to flexible unicellular insulation in outside locations.

D. Hangers and Anchors: Pipe insulation shall be continuous through pipe hangers. Where pipe is supported by the insulation, provide MSS SP-58, Type 40 galvanized steel shields or MSS SP-58, Type 39 protection saddles conforming to MSS SP-69. Where shields are used on pipes 2 inches and larger, provide insulation inserts at points of hangers and supports. Vapor seal insulation around anchors. Insulation inserts shall be of calcium silicate, cellular glass (minimum 8 pcf), molded glass fiber (minimum 8 pcf), or other approved material of the same thickness as adjacent insulation. Inserts shall have sufficient compressive strength to support the pipe without compressing the inserts to a thickness less than the adjacent insulation. Insulation inserts shall cover the bottom half of the pipe circumference 180 degrees and be not less in length than the protection shield. Vapor-barrier facing of the insert shall be of the same material as the facing on the adjacent insulation. Where protection saddles are used, fill all voids with the same insulation material as used on the adjacent pipe

E. Sleeves: Where penetrating interior walls, extend a metal jacket 2 inches out on either side of the wall and secure on each end with a band. Where penetrating floors, extend a metal jacket from a point below the back-up material to a point 10 inches above the floor with one band at the floor and one not more than one inch from end of metal jacket. Where penetrating exterior walls, extend the metal jackets through the sleeve to a point 2-inches beyond the interior surface of the wall.

F. Flanges, Unions, Valves and Fittings Insulation for Hot Piping: Factory fabricated removable and reusable insulation covers may be used. For domestic hot water, heating hot water, A/C condensate drains, steam and condensate return systems; exposed hot water piping and drains in handicap areas, place factory premolded, precut or field-fabricated segmented insulation of the same thickness and conductivity as the adjoining pipe insulation around the flange, union, valve, and fitting abutting the adjoining pipe insulation. Elbows insulated using segments shall have not less than three segments per elbow. Place and joint the segments with manufacturer's recommended water vapor resistant, fire retardant, and adhesive appropriate for the temperature limit of the service. Upon completion of installation of insulation, apply two coats of lagging adhesive with glass tape embedded between coats. Where unions are indicated not to be insulated, taper the insulation to the union at a 45 degree angle. Coat the insulation and all-purpose jacket with two coats lagging adhesive and with glass tape embedded between coats. Factory pre-mold one-piece PVC fitting covers may be used in lieu of two coats of adhesive with tape embedded between coats. Factory premolded field-fabricated segment or blanket insert insulation shall be used under the fitting covers. Install factory premolded one-piece PVC fitting covers over the insulation and secure by stapling, taping with PVC vapor barrier tape, or with metal or plastic tacks made for securing PVC fitting covers.

G. Flanges, Unions, Valves, Anchors, Fittings for Cold Piping: Factory-fabricated removable and reusable insulation covers may be used. For piping insulation, domestic cold water, chilled water supply and return, refrigerant suction, drinking fountain drain piping to sewer tie-in, horizontal roof drain leaders, and exposed lavatory drains, coat pipe insulation ends with vapor barrier coating not more than six inches from each flange, union, valve, anchor or fitting. Place insulation

of the same thickness and conductivity as the adjoining pipe insulation (either premolded or segmented) around the item, butting the adjoining pipe insulation. Elbows insulated using segments shall not have less than 3 segments per elbow. Apply two coats of vapor barrier coating with glass tape embedded between coats. Overlap tape seams one inch. Extend the coating out onto the adjoining pipe insulation 2 inches. Seal the insulation and jacket with two coats of vapor barrier coating with glass tape embedded between coats. Insulate anchors attached directly to the pipe for a sufficient distance to prevent condensation but not less than 6 inches from the insulation surface. At the option of the Contractor, premolded, one-piece polyvinyl chloride (PVC) fitting covers may be used in lieu of the embedded glass tape. Factory premolded insulation or filed-fabricated insulation segments shall be used under the fitting covers. Secure the covers with adhesive and vapor barrier tape, or with tacks made for securing PVC covers. Then coat all tape seams and tacks with vapor barrier coating.

3.3 DUCTS AND PLENUMS (HVAC) INSULATION:

A. General: Insulate return ducts, outside air intakes, supply ducts to the room outlets, exhaust ducts, flexible run outs, plenums, casings, mixing boxes, filter boxes, coils fans, and the portion of air terminals not in the conditioned spaces. Insulation shall be continuous through sleeves, wall and ceiling openings. Extend all surface finishes to protect all surfaces, ends, and raw edges of insulation. Provide a moisture and vapor seal where insulation terminates against metal hangers, anchors and other projections through the insulation on surfaces for which a vapor seal is specified. Bevel and seal the edges of exposed insulation.

B. Rigid Insulation: Secure rigid insulation by impaling over pins or anchors located not more than 3 inches from joint edges of boards, spaced not more than 12 inches on centers and secure with washers and clips. Spot weld anchor pins or attach with a waterproof adhesive especially designed for use on metal surfaces. Apply insulation with joints tightly butted. Neatly bevel insulation around name plates and access plates and doors. Cut off protruding ends of pins, after clips are sealed with coating compound.

C. Flexible Blanket Insulation: Apply insulation with all joints tightly butted. Secure insulation to ductwork with adhesive in 6-inch wide strips on 12 inch centers. Staple laps of jacket with outward clinching staples and seal with foil scrim kraft (FSK) tape. For ductwork over 24-inches on horizontal duct runs, provide pins, washers and clips. Use pins on sides of vertical ductwork being insulated. Space pins and clips on 18 inch centers and not more than 18 inches from duct corners. Carry insulation over standing seams and trapeze-type hangers. Install speed washers with pins and pin trimmed to washer. Sagging of flexible duct insulation will not be permitted. Cut off protruding ends of pins after clips are secured and sealed with coating compound. Vapor seal all joints and staple.

D. Insulation Finishes and Joint Sealing: Fill all breaks, punctures, and voids with vapor barrier coating compound. Vapor seal all joints by embedding a single layer of 3-inch wide open weave glass membrane, 20 by 20 mesh maximum size between two 1/16-inch wet film thickness coats of vapor barrier coating compound. Draw glass fabric smooth and tight with a 1-1/2 inch overlap. At

jacket penetrations such as hangers, thermometers, and damper operating rods, fill voids in the insulation with vapor barrier coating. Brush a coat of vapor barrier coating on HVAC ducts. Provide vapor barrier jacket continuous across seams, reinforcing, and projections. Where height of projections is greater than insulation thickness, carry insulation and jacket over the projection.

E. Access Plates and Doors: On acoustically lined ducts, plenums, and casings, provide insulation on access plates and doors. On externally insulated ducts, plenums, and casings, provide insulation-filled hollow steel panels and doors for access openings. Bevel insulation around access plates and doors.

3.4 EQUIPMENT INSULATION:

A. General Procedures: Apply equipment insulation suitable for temperature and service in rigid block or semi-rigid board or flexible form to fit as closely as possible to equipment. Stagger end joints where possible. Bevel the edges of the insulation for cylindrical surfaces to provide tight joints. Join sections of cellular glass insulation with bedding compound. After the cellular glass insulation is in place on areas to be insulated, except where metal-encased, fill joints, seams, chipped edges, or depressions with bedding compound to form a smooth surface. Fill mineral fiber joints with insulating cement conforming to ASTM C 195. Bevel insulation around name plates, ASME Stamp, and access plates. For insulation on equipment that must be opened periodically for inspection, cleaning, or repair, construct insulation to be removable and replaceable without damage. Protect exposed insulation corners with corner angles under wires and bands.

B. Pumps: Insulate pumps used for chilled water with 2-inch thick rigid mineral fiber insulation as follows:

1. Insulate pumps by forming a box around the pump housing, drive shaft, and piping. Apply insulation to inside surfaces of 20-gauge stainless steel sheet-metal boxes having openings for drive shaft and pipes. Construct the box by forming the bottom and sides using joints which do not leave raw ends of insulation exposed. Band bottom and sides to form a rigid housing that does not rest on the pump. Between top cover and sides, fit joints tightly forming a female shiplap joint on the side pieces and a male joint on the top cover to make the top cover removable. Secure insulation to the box with adhesive. Allow clearance for draining and adjustment of pump shaft seal.

TABLE 1 INSULATION MATERIAL FOR PIPING					
SERVICE	MATERIAL	SPECIFICATION	TYPE	CLASS	VAPOR BARRIER REQUIRED
Refrigerant Suction	Flexible Unicellular	ASTM C 547	I or II	1	No
Chilled Water	Cellular Glass	ASTM C 552	II	2	No
	Flexible Unicellular	ASTM C 547	I or II	1	No
Heating Hot Water	Mineral Fiber	ASTM C 547		1	No
	Flexible Unicellular	ASTM C 434	I or II	1	No
Domestic Hot Water	Mineral Fiber	ASTM C 547		1	No
Domestic Cold Water	Mineral Fiber	ASTM C 547		1	Yes
A/C Condensate Drain	Flexible Unicellular	ASTM C 534	I or II		No
Drinking Fountain Drain	Flexible Unicellular	ASTM C 534	I or II		No
Exposed Domestic Hot Water Piping & Drains to Areas for Handicapped Personnel	Flexible Unicellular	ASTM C 534	I or II		No

TABLE 2

INSULATION SIZES FOR PIPING

SERVICE	MATERIAL	1/4" - 1-1/4"	1-1/2" - 3"	4" - UP
Refrigerant Suction	Flexible Unicellular	¾”	¾”	¾”
Chilled Water	Cellular Glass	1”	1-1/2”	2”
	Flexible Unicellular	¾”	N/A	N/A
Heating Hot Water	Mineral Fiber	1”	1-1/2”	2”
	Flexible Unicellular	¾”	N/A	N/A
Domestic Hot Water	Mineral Fiber	1”	1”	1-1/2”
Domestic Cold Water	Mineral Fiber	½”	½”	½”
A/C Condensate Drain	Flexible Unicellular	½”	½”	½”
Drinking Fountain Drain	Flexible Unicellular	½”	½”	½”
Horizontal Roof Drain Leader (Including Underside of Roof Drain)	Mineral Fiber	½”	½”	½”
Exposed Domestic Hot Water Piping & Drains to Areas for Handicapped Personnel	Flexible Unicellular	½”	½”	½”

END OF SECTION

SECTION 23 09 00

CONTROLS AND INSTRUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Section 23 01 00 - Mechanical General Requirements, with modifications and additions specified herein, apply to the work specified in this Section.

1.2 SECTION INCLUDES:

A. Complete system of automatic controls.

B. Instrumentation.

1.3 SUBMITTALS:

A. Submit product data and shop drawings under provisions of Section 23 01 00.

B. Shop drawings shall indicate operating data, system diagrams, wiring diagrams, interlock diagram indicating inter-connection for all motor starters, description of operating sequences, and sizing of components.

C. Provide product data for each manufactured component.

D. Include list of instruments which indicates use, range, and location.

PART 2 – PRODUCTS

2.1 DDC CONTROLS

General: The new control system shall be a BACnet platform that may use Siemens, Johnson Controls, or Automated Logic controls. The system shall be designed with a connection to the existing front end for visibility and control. The system MUST tie to the new Siemens Disego front end system. The current control points shall remain as a minimum.
Include all software, hardware upgrades, and programming. The system shall include (as a minimum) all controllers for:

1. Boiler enable/disable with BACnet connection to boiler for readout of temperatures, alarms, setpoints, rate of fire, and status. Existing shall remain.
2. Chill water from plant shall remain as existing. Maintain points.
3. Pumps shall have status, enable/disable, pressure drop for VFD control – shall remain.
4. Air Handler shall have BACnet connection for osa temperature, mixed air temperature, supply temperature, freeze protection routine with hard wire devices, damper positions, fan speed, airflow station output for osa, chill water

valves (positioning), hot water valves (positioning), over pressure safety, smoke detector shutdown, filter status and alarm (pre and post filters), and water temperatures for inlet and outlet for hot and chill water. Tie to new controller and interface complete with graphics to front end.

5. Thermostats (sensors): shall be adjustable by user in public areas and sensor only with front end control at dorm rooms. Existing shall remain.
6. Room toilet exhaust fans shall be provided for with interlock to lights.
7. Graphics – provide full graphics for all replaced or new equipment.
8. Trends – allow for trending of ahu for temperature, and humidity.
9. Controllers: provide panels and hardware as required, building shall be able to operate independently of front end, provide a laptop with software at main panel to allow system access at that location.
10. Coordination: some equipment will come complete with BACnet card for connection, this contractor will coordinate if provided by vendor and supply controller with all devices if equipment lacks the Bacnet card and factory devices. This contractor shall coordinate all devices requiring 120v with trades prior to award of contract. Notify engineers of any missing power for devices to allow pricing prior to award.

2.2 A. Instrumentation and Control Devices

A. Actuators and Operators

1. Electric Actuator : Valve and Damper Operators: Operators shall be provided for each automatic valve and damper and shall be of sufficient capacity to operate the valve or damper under all conditions, and to guarantee tight close of the devices against system pressures encountered. Each operator shall be full-proportioning type unless indicated otherwise and shall be provided with spring-return to fail-safe as required to meet conditions. Each operator shall operate at the rate of speed corresponding to the dictates of the controller. Where sequencing is required, the operators shall be provided with positive positioning devices and adjustable operating range and starting point. Electric operators shall be hydraulic or oil immersed gear-train type with machine cut gears.

B. Sensors and Transmitters

1. Temperature

a) Firestat: UL approved and listed, factory set in accordance with ANSI/NFPA 90A with normally closed contacts, manual reset.
b) Freezestat – device shall use a manual trip/reset when temperature falls below 35F. DDC controls shall send alarm. Dampers shall close, fan is off, chill water and hot water valves open.

C. Dampers

1. Control Dampers: Frames shall be constructed of galvanized welded steel with welded or riveted corner reinforcement. Blades shall be galvanized steel, maximum blade size 8 inches wide, 48 inches long, attached to minimum 1/2 inch shafts with set screws. Blade seals shall be synthetic elastomeric or

neoprene mechanically attached. Shaft and linkage bearings shall be oil impregnated sintered bronze or graphite impregnated nylon sleeve. Leakage shall be less than two percent based on approach velocity of 2000 ft/min and 4 inches wg. Test in accordance with AMCA 500.

D. Miscellaneous Control Devices

1. Control Transformers: Control transformers shall be furnished if control system requires other than available electrical power. Transformers shall have a service factor of not less than 1.5 at the design electric consumption.

2. Motor Starters and Contactors: Provide magnetic motor starters for each piece of motor operated mechanical equipment installed unless motor starter is in the motor control center specified to be furnished under Electrical Work. Starters shall provide overload protection, properly sized, in each phase. Starters shall be enclosed in a NEMA 1 enclosure where installed indoors and enclosed in a NEMA 3R enclosure where installed outdoors. Provide heavy duty Contactors for 120 volt fractional horsepower motors that have internal overload protection.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: The control system shall be installed, tested, and adjusted by competent mechanics under the supervision of the contractor for the work specified to be furnished under Section 23.

B. Electrical Work: All power wiring is specified to be furnished under Electrical Work of these specifications. Furnish the contractor for the electrical work, equipment electrical requirements and other data pertaining to the electrical phases of the mechanical installation. All control wiring of the mechanical systems shall be accomplished under this Division. Control and interlock wiring shall be fully color coded, numbered using Brady Stick-On numbers, in conduit, and shall comply with all the requirements of Electrical Work.

C. Coordination: Any changes in the required controls as a result of equipment substitution under this division shall be the responsibility of the contractor for this division and shall be accomplished at no additional cost to the owner.

3.2 INSTRUMENT INSTALLATION:

3.3 SEQUENCE OF OPERATION:

a) See drawings for sequence of control.

END OF SECTION

SECTION 23 20 00 HEATING AND AIR CONDITIONING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Section 23 01 00 - Mechanical General Requirements, with modifications and additions specified herein, apply to the work specified in this Section.

1.2 SECTION INCLUDES:

A. Refrigerant Piping

B. Hydronic Piping

C. Drain, Vent, and Overflow Piping.

1.3 SUBMITTALS:

A. Submit product data and shop drawings under provisions of Section 23 01 00.

B. Submit certification of pipe conformance to Specification.

C. Submit well installers qualifications.

1.4 Quality Assurance

A. Welders' Certification: In conformance with AWS D1.1.

B. For each product, provide components by same manufacturer throughout.

PART 2 - PRODUCTS

2.1 BASIC MATERIALS:

A. Refer to Section 22 05 00, BASIC MATERIALS AND METHODS, for basic piping materials.

B. General: All piping in conjunction with the heating and air conditioning system shall be complete as indicated on the drawings or as required for the proper operation of the system.

2.2 REFRIGERANT PIPING:

A. Hard Drawn:

1. Tubing: Type ACR hard drawn conforming to ASTM B 280.

2. Fittings: Wrought copper fittings conforming to ANSI B16.22.

3. Joints: Silver brazed joints conforming to ANSI A5.8.

B. Soft Drawn (Accepted Up To 3ft Maximum Length):

1. Tubing: Type K copper tubing conforming to ASTM B88

2. Fittings/Joints: Flared tube end with compression type fittings conforming to ASME/ANSI B16.26.

C. Sight Glass: A combination moisture and liquid indicator, double port type, UL listed. The indicator shall have a glass port for complete view of the refrigerant flow and moisture sensitive indicator of the type that changes color. Sight glass shall be equal to Sporlan "See-All".

D. Driers: Permanent type liquid line dehydrator with inlet and outlet shut-off valves. Driers shall be equal to Sporlan "Catch-All".

E. Expansion Valves: The valves shall be of the stainless steel diaphragm type with external equalization and external super-heat adjustment set for 10°F super-heat.

F. Shut-Off-Valves: Manual valves shall be for refrigeration service with back seating construction and cap seals. Valves shall be Mueller Brass or approved equal.

2.3 HYDRONIC PIPING

A. Chill and Hot Water Piping

1. Interior Piping Up to 2”:

a) Tubing: Hard drawn type L copper conforming to ASTM B88.

b) Fittings: Wrought copper fittings conforming to ASTM B16.22 or cast brass fittings conforming to ANSI B16.18.

c) Joints: Grade 95TA soldered joints conforming to ASTM B 32 or brazed joints conforming to AWS A5.8.

2. Interior Piping 2” and Above:

a) Piping: Schedule 40 Black steel pipe conforming to ASTM B36.10/19.

b) Fittings: Factory made butt-welding fittings conforming to ASTM B16.9 or factory made and assembled grooved joint fittings with synthetic rubber gasket conforming to ANSI C-606.

B. Make-up Water Piping: Copper tubing, hard drawn, Type L, conforming to ASTM B 88 with fittings and specialties as specified in Section 22 00 00.

2.4 DRAIN, VENT, AND OVERFLOW PIPING: Materials: Schedule 40 PVC or copper tubing, Type L, conforming to ASTM B 88 with cast-brass or wrought-copper sweat joint fittings. Drains at air handling units shall be provided with water seals, depth equal to the total static pressure of the blower, constructed of two tees and an appropriate U-bend with open end of each tee plugged. Pipe and equipment drains with valves shall provide complete draining of all systems. Pipe to nearest open-sight drain, floor drain, wet vent, or as indicated on drawings.

2.5 HYDRONIC SPECIALTIES:

A. Air Vents:

1. Manual Type: Short vertical section of 2-inch diameter pipe to form an air chamber, with 1/8 inch brass needle valve at top of chamber.

2. Float Type: Brass or semi-steel body, copper float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

3. Hygroscopic Type: Brass with hygroscopic fiber disc, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

B. Modular Valve Assemblies: Provide and install for each fan coil or device (where replacing or adding per plans), utilizing hydronic cooling or heating, multi-function valve assemblies as constructed by Flow Design Inc. or prior approved equal. Each coil shall be equipped with an Autoflow FV control valve with dynamic flow control. The valve and components shall be non-ferrous, threaded ends, and include a ball valve union, a PT plug, and control valve (balancing). Also include on each coil on the supply side an Autoflow SV valve of non-ferrous construction. The assembly shall include a union, strainer, blowdown cock, and PT plug. Provide to Owner one Flow Set Meter kit designed for direct GPM readouts, temperature, and pressure drop. Entire assembly shall be in a case with all hoses and taps for use with the corresponding equipment. Contractor shall also provide and install 3 foot long flexible braided hoses with swivel ends to each coil from the main. Contractors may have to provide hard piping from main to allow length of hose to work correctly. Insulate hoses with Armaflex or equal.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Piping shall comply with the general piping installation specified in Section 22 05 00, Basic Materials and Methods.

B. Install specialties in accordance with manufacturer's instructions to permit intended performance.

C. Provide automatic air vents at all high points of system, use cock to allow vent removal.

D. Provide valved drain and hose connections on all strainers and riser low points.

E. Dry refrigerant systems per manufacturers direction. Purge all systems with inert gas similar to nitrogen prior to pulling vacuum and charging system.

END OF SECTION

SECTION 23 30 00 AIR DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Section 23 01 00 - Mechanical General Requirements, with modifications and additions specified herein, apply to the work specified in this Section.

1.2 SECTION INCLUDES:

A. Ductwork and Ductwork Accessories.

B. Grilles and Registers

1.3 SUBMITTALS:

A. Submit product data and shop drawings under provisions of Section 23 01 00.

1.4 REGULATORY REQUIREMENTS:

A. Construct Ductwork to recommendations in SMACNA Duct Construction Manual, and to the requirements of NFPA 90A.

PART 2 - PRODUCTS

2.1 DUCTW0RK MATERIALS:

A. Sheet Steel for Ducts: ASTM A 525 and ASTM A 527 galvanized sheet steel, lock-forming quality, having zinc coating of 1.25 oz. per sq. ft. for each side in conformance with ASTM A 90.

B. Galvanized Steel Hot Dipped After Fabrication: ASTM A 123.

C. Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

2.2 LOW PRESSURE DUCTS: All ducts except high pressure supply ducts from the central air handling unit serving variable volume terminal units.

A. General: Construction, metal gauge, and reinforcements shall conform to NFPA 90A and SMACNA LPDCS. Ductwork shall be airtight and shall not vibrate or pulsate when system is in operation. Air leakage shall be less than 5 percent of system capacity. Construct ductwork of galvanized steel.

B. Curved Elbows: Make curved elbows with a centerline radius not less than 1-1/2 times the width or diameter of the duct.

C. Joints and Laps: Make substantially airtight. Make laps at joints in the direction of air flow. Button-punch or bolt-connection in standing seams shall be spaced at fixed centers not greater than 6 inches. "Button Punch Snap-Lock" may be used instead of Pittsburgh Lock.

2.3 FLEXIBLE DUCT

A. Characteristics of flexible duct:

1. Approved as UL-I81 Class 1 air duct.

2. Flame spread rating less than 25 and smoke developed rating less than 50.

3. Rated for 10" wg. positive pressure, 4" wg. negative pressure, and 4000 fpm air velocity.

4. Tear and puncture resistant reinforced duct fabric mechanically locked together with a corrosive resistant galvanized steel helix.

5. Insulated with minimum l/2"thick fiberglass insulation with vapor barrier jacket.

B. Seal off the insulation jacket at its ends and at joints with mastic, equal to Hardcast Duct-Seal 321. Sealants, mastics used for flexible duct connectors shall be listed and labeled in accordance with UL-18lB. Replace flexible duct if jacket is punctured.

C. Flexible duct is NOT to be used for run outs where it must pass through walls or through smoke or fire partitions. Flexible duct is not to be used in exposed application. Flexible duct lengths shall not exceed 6 feet at each connection.

D. No bends shall be made in flexible duct with the center line radius less than one and one-half duct diameter and only one bend may occur per 6 foot length of duct material.

2.4 DUCTWORK ACCESSORIES:

A. FIRE DAMPERS:

1. Fire dampers to be U.L. listed in accordance with UL-555. Fire dampers to be held in an open position with a 165 degree F fusible link and arranged to lock in position on closure.

2. Fire dampers for rectangular duct to be type "B" and for round duct to be Type "C". Fire dampers located behind sidewall registers and grilles and others specifically indicated on drawings to be Type "A". Fire dampers to be multi-leaf type with spring closing for horizontal mounting and weighted-gravity closing for vertical mounting. Dampers to be steel construction with rust resistant finish and provided with factory installed mounting sleeve suitable for structure. Mount per manufacturer's published D.L. approved installation instructions.

3. See Architectural drawings for hour-rating of walls and/or floors. Dampers to be compatible with indicated ratings.

B. DAMPERS

1. Automatic Control Dampers: All automatic control dampers to be furnished by Control Subcontractor and installed by this Contractor (except unit mounted dampers).

a) Automatic control dampers to be low-leak, galvanized steel or aluminum construction parallel blade type, Ruskin Model CD36 or approved equal.

b) Dampers to be complete with minimum 4" deep, 16 gage hat-shaped channel

frame, minimum 16 gage blades on maximum 6" centers, 1/2" diameter shafts, and corrosion resistant bearings.

c) Dampers to have extruded vinyl blade seals and stainless steel or aluminum flexible metal compression type jamb seals to limit leakage to a maximum of 1/2% (maximum of 5.4 cfm/sq. ft. leakage for 48" x 48" size damper) when tested in accordance with AMCA Standard 500,

d) Motor actuator to be oil immersed gear train, 120-volt line voltage type with spring return. to closed position on power interruption. Provide Honeywell Model M445/845 or approved equal complete with damper linkages.

2. Manual Volume Dampers (MVD): Manual volume dampers to be hand-operated type dampers constructed of galvanized steel, minimum 22 gauge for duct widths 18" and less, minimum 16 gauge for duct widths greater than 18". Dampers for ducts to 12" height and 12" diameter to be single blade carried on a 3/8" round steel rod mounted inside of duct without frame and fitted with locking type quadrant and brass end bearing plate accurately drilled and secured to duct. Dampers for ducts greater than 12" height to be multiblade type, 12" maximum blade width up to 30" blade length and 10" maximum blade width over 30" blade length. Blades to be mounted on frame with brass sleeve bearings interconnected for operation from one locking type hand quadrant. Round pivot rods to have section faced flat to receive locking setscrew in locking quadrant. Refer to SMACNA manual Figures 2-14 and 2-15.

C. FLEXIBLE CONNECTORS: Install UL listed flexible duct connectors between duct and fan/equipment connections. Flexible duct connectors to be made of 28 ounce, heavy glass fabric double coated with neoprene. Seal duct connection with mastic equal to Hardcast Duct-Seal 321. Sealants, mastics used for flexible duct connectors shall be listed and labeled in accordance with UL-I8IB.

D. DUCT SLEEVES: Duct sleeves shall be provided for all ducts passing through floors, walls, ceilings, or roof and shall be installed by the contractor for this Section during the construction of the building. Sleeves Shall be wood, galvanized sheet steel, or other approved materials to meet the conditions encountered.

E. DUCT CLOSURE COLLAR: A collar constructed of galvanized sheet steel not less than 4-inches wide shall be provided on each side of floors, walls, partitions, and under ceilings at each duct sleeve except where grilles, registers, or diffusers are installed. Collar shall be installed and secured tight against the surfaces. Collars at fire and smoke dampers shall be 1-1/2-inch by 1-1/2-inch by 10-gauge steel angles as indicated in the SMACNA Guide.

F. TURNING VANES: Turning vanes shall consist of double thickness curved metal blades or vanes rigidly mounted in a runner, arranged so as to permit the air to make the abrupt turns without appreciable turbulence, shall be the manufacturer's standard products and shall be quiet and free from vibration when the system is in operation.

G. DUCT ACCESS DOORS

1. Duct access doors to be provided for access to all coils, fire, fire/smoke, and smoke dampers, automatic and backdraft dampers, duct smoke detectors, static pressure and air volume sensing devices, and other equipment installed in ducts and at other points indicated on drawings.

2. Access door construction and air tightness must be suitable for the duct pressure class used (low, medium, or high).

3. Access doors to be double-panel, galvanized steel construction with minimum 1" rigid insulation between panels. Access doors in exhaust duct and unlined return duct may be un-insulated single panel, galvanized steel construction. Doors to mount in rigid frame constructed of formed galvanized steel. Angle iron bracing to be used as required to provide rigid assembly. Doors to hinge on one side with door latch on opposite side.

4. Access doors in ductwork shall fully comply with Figure 2-10 and 2-11 of SMACNA manual. Casing access doors shall fully comply with Figure 6-11 and 612 0f SMACNA manual.

5. Doors to close against gasket seal.

2.5 Grilles, Registers, and Diffusers

A. Manufacturers: Price, Titus, Nailor, or approved equal.

B. SQUARE CEILING DIFFUSERS: Provide Titus TDC-AA or approved equal round or square neck, louvered face ceiling diffusers at all locations designated by schedule on drawings. Diffusers to be all aluminum construction each complete with opposed-blade volume damper. Frame to be flush mount for diffusers in "hard" ceilings and lay-in T-bar mount for diffusers in lay-in ceilings. Finish to be baked-on, off-white enamel.

C. SIDEWALL RETURN REGISTERS: Provide Titus 1700 or approved equal at locations indicated on drawings. Registers to be all aluminum construction complete with opposed-blade volume control and removable and rotating fixed horizontal blade core. Finish to be baked-on, off-white enamel. Border to be curved, Titus Type C.

D. CEILING RETURN & EXHAUST REGISTERS: Provide Titus Model 50-F or approved equal at locations designated on drawings. Registers to be complete with 1/2" cube egg-crate aluminum grid, and opposed-blade volume damper. Finish to be baked-on, off-white enamel. Border to be flush mounted frame style.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Installation shall conform to NFPA and SMACNA. Provide mounting and supporting of ductwork and accessories including, but not limited to, structural supports, hangers, vibration isolators, stands, clamps and brackets, access doors and dampers. Install ductwork accessories as indicated in accordance with the manufacturer's printed instruction. Allow clearance for inspection, repair, replacement, and service.

B. Ductwork: Install airtight. When air distribution systems are operated, there shall be no chatter, vibration, or dust marks.

Duct Supports: Ducts shall be supported by not less than two 1-inch wide by 1/16-inch thick galvanized strap of sheet steel hangers located one on each side of duct, spaced not over 5-feet on centers for round ducts and not over 6-feet on centers for ducts up to 24-inches wide and not over 3-1/2-feet on centers for ducts over 24-inches wide. Support flexible ducts every 3 feet. Provide sway bracing. Anchor risers in the vertical run to allow ends of riser free vertical movement. Attach supports only to structural framing members and concrete slabs. Provide suitable metal intermediate framing where supports are required between structural framing members. Do not support ducts from metal decking.

C. Fire and smoke Dampers: All devices shall adhere to the UL listed installation based on wall construction and the fire/smoke damper rating. The automated dampers that include a spring return operator shall be mounted for correct operation. The controls contractor shall be responsible to insure the operation of fire/smoke dampers with operators are connected to a fire alarm connection. Coordinate with fire alarm contractor to insure all relays and terminals are able to accept the device. Provide a control transformer if power for device is required.

END OF SECTION

SECTION 238060 – BUILDING AUTOMATION SYSTEM COMMISSIONING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Building Automation System (BAS) Startup and Functional Performance Testing.

B. Validation of proper and thorough installation of BAS and associated equipment.

C. Generic Start-Up Documentation for BAS.

D. Development of final Start-Up Documentation for BAS.

E. Functional Performance Testing of BAS.

F. Coordination of BAS-related training.

G. Documentation of BAS Operation and Maintenance Documentation.

H. BAS Control Sub-Systems coordination with BAS Systems.

1.02 GENERAL DESCRIPTION

A. This section defines responsibilities of the Building Automation System Contractors to commission the BAS and all BAS control Sub-Systems. Sub-Systems are considered to be any control system that must integrate with the BAS.

B. Commissioning (Cx) is the process of ensuring that (i) all building systems are installed and perform interactively per the design intent; (ii) that systems are efficient and cost effective and meet the Owner's operational needs; (iii) that the installation is accurately documented; and (iv) that the Operators are adequately trained. Commissioning serves as a tool to minimize post- occupancy operational problems, and establishes testing and communication protocols to advance the building systems from installation to optimized, fully-dynamic operation.

C. Commissioning Authority (CA) shall work with the Contractors and the design engineers to direct, oversee and execute some portions of the Cx process.

D. The Commissioning Plan outlines the Cx process beyond the Construction Contract, including design phase activities and design team/owner responsibilities. The specification Sections dictate all requirements of the commissioning process relative to the construction contract. The Cx Plan is not part of the construction contract, although it is available for reference at the request of the Contractor.

1.03 SCOPE

A. The scope of Commissioning on this project shall include the entire BAS system and all sub-systems connected to or integrated with the BAS.

1.04 RELATED WORK AND DOCUMENTS

A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this specification and shall be used in conjunction with this section as part of the contract documents. See Division 01 for details.

B. The Cx process references many related Sections, particularly Section 019100 - General Commissioning Requirements. It is important for all Contractors subject to the Cx process to be familiar with Section 019100.

C. Section 019110 – General Commissioning Requirements for Functional Performance Testing.

D. Section 220800 – Plumbing System Commissioning.

E. Section 230800 – HVAC System Commissioning.

F. Section 260800 – Electrical Systems Commissioning.

1.05 REFERENCE STANDARDS

A. ASHRAE Standard 202 – Commissioning Process for Buildings and Systems.

B. ASHRAE Guideline 0 – The Commissioning Process.

C. ASHRAE Guideline 1.1 – HVAC&R Technical Requirements for the Commissioning Process.

D. ASHRAE Guideline 1.3 – Building Operations and Maintenance Training for the HVAC&R Commissioning Process.

E. ASHRAE Guideline 1.4 – Procedures for Preparing Facility Systems Manual.

1.06 CONTRACTOR RESPONSIBLITIES

A. General commissioning responsibilities of the BAS Contractor are specified in Section 019100. The following indicate additional specific responsibilities of the BAS Contractor.

B. Completely install and thoroughly inspect and document all systems and equipment.

C. The BAS Contractor will:

1. Attend Commissioning (Cx) progress and coordination meetings.
2. Prepare and submit required draft forms and systems information.
3. Establish trend logs of system operation as specified herein.
4. Perform verification and performance testing as documented in all Startup Procedures.
5. Demonstrate system operation.
6. Provide instrumentation necessary for verification and performance testing.
7. Provide POTs or operator workstations in locations convenient to testing activities as specified below.
8. Provide CA with appropriate passwords, keys, and access to control panels and workstations.
9. Manipulate systems and equipment to facilitate Functional Performance Testing as outlined in in the specifications. Typically, this will only be for initial samples of like systems.
10. Train Owner’s Representatives as specified in Part III of this section.

11. Within six months of the acceptance test the CA will request opposite season testing for HVAC and controls work. BAS contractor will participate in this testing and remedy any deficiencies identified.

D. Where control systems do not allow a test mode or the overriding of physical input values for testing, program an interim virtual point for all inputs that can be used to represent the point to facilitate operator selectable input values for testing.

E. Provide a control technician to work at the direction of the CA for software optimization assistance for a minimum of 20 hours during the Acceptance Phase of the project.

F. Controls Parameter Matrix: Contractor shall provide a form summarizing all setpoints and alarm parameters and alarming strategies for the Owner to complete. Organize a meeting to discuss the desired initial setpoints and alarm parameters. Contractor shall enter the requested setpoints and alarm parameters at completion of start-up and record the applicable settings in the Start-Up Documentation.

G. Final Systems Operation Training: The BAS Contractor shall train the Owner and Operators on whole-building operation and/or use of the BAS. This training shall focus primarily on BAS control of building systems and operation and its impact on building performance, and shall be conducted after Functional Completion. Additional information is provided in Section 019100.

1.07 SUBMITTALS

A. Submit the following Quality Assurance / Quality Control documentation:

1. Quality Assurance Plan.

a. Contractor must provide a description of their quality assurance operations for the commissioning phase of this project. The description shall include protocols for each step of commissioning listed within this section including testing, reporting, coordination with the CA and remediation of all action items.

B. Submit the following items as required and defined within the process:

1. BAS Start-Up Report (reference Div. 01 and BAS Testing, Adjusting & Calibration Section below): Submit one (1) electronic copy prior to scheduling of Functional Performance Testing.
2. BAS Training Plan (defined below): Submit prior to scheduling BAS Demonstration.
3. Captured trend and alarm logs as required during the Acceptance Period and Warranty Period.
4. Signoff certifying all startup and commissioning work described in this section has been completed. Signoff must include completion of seasonal testing work.

1.08 CX PROCESS SEQENCING

A. Refer to Section 019100.

B. The following list outlines the general sequence of events for Commissioning of the BAS.

1. Construction Phase:

a. Collaborate on construction scheduling.

b. Submit Product data and Shop Drawings, and receive approval.
c. Meet with Cx Team to coordinate with all trades.
d. Submit Control Logic Documentation, and receive approval.
e. For Biological Safety Level (BSL) spaces, provide detailed wiring and device mounting design. Confirm control related imbeds and penetrations. Collaborate on coordination issues.
f. Begin BAS installation.
g. Submit refinement of generic Start-Up Documents incorporating manufacture-specific start-up requirements accompanied by manufacturers pre-printed start-up forms for all equipment provided by the BAS Contractor.
h. Receive BAS Start-Up Documents approval from CA.
i. Submit Training Plan content.
j. Receive approval of Training Plan content.
k. Provide the Controls Parameter Matrix and receive approval.
l. Provide sample graphics and receive approval.
m. Complete BAS installation.
n. Place systems under BAS control.
o. Enter alarms as approved by Owner.
p. Complete BAS graphics.
q. Perform BAS system start up and complete Start-Up Documentation.
r. Submit completed BAS Start-Up Documentation.
s. Prepare and initiate trend log data storage and format trend graphs.
t. Train Owner on BAS operation and maintenance.
u. Formal BAS System Turn-Over Meeting.
v. Submit commissioning BAS Software/Access and provide full access or as mandated by the Owner, password access to Owner and CA.
w. Receive BAS Start-Up Documentation approval and approval to schedule BAS demonstration of completeness.
x. Demonstrate systems to CA and Owner.
y. Submit trend logs in format specified.
z. Receive FPT or BAS demonstration approval and approval to schedule Acceptance Phase.

2. Acceptance Phase:

a. 14-day BAS Observation Period to witness stable BAS operation.
b. Receive Observation Period approval which enables start of Functional Performance Testing.
c. CA performs Functional Performance Testing and BAS Contractor participates in initial samples.
d. Receive Functional Completion approval from CxA for the BAS.

3. Substantial Completion:

a. Endurance Period.

4. Warranty Phase:

a. Provide administrator access password access to Owner.
b. Train Owner on final sequences and modes of operation (Final Systems Operation Training).
c. Update Systems Manual content with any changes.
d. Revise and re-submit record drawings and O&M manuals.
e. Install framed control drawings.
f. Final Completion.
g. Opposite-season operational test and Functional Performance Testing.

h. Receive opposite-season operational test and FPT approval.
i. Revise and re-submit record drawings and O&M manuals.
j. Update framed control drawings.
k. Complete owner training.
l. End of Warranty Period.

PART 2 - PRODUCTS

2.01 INSTRUMENTATION

A. General: All testing equipment used by any Party shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:

1. Temperature sensors and digital thermometers shall have a certified calibration within the past year and a resolution of +/- 0.1F.
2. Pressure sensors shall have an accuracy of +/- 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.
3. All equipment shall be calibrated per the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.

B. Standard Testing Instrumentation: Standard instrumentation used for testing air and water flows, temperatures, humidity, noise levels, amperage, voltage, and pressure differential in air and water systems related to functional testing shall be provided by CA.

C. Special Tools: Special equipment, tools, and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, per these Contract Documents shall be included in the base bid price to the Contractor and turned over to the Owner upon project completion.

2.02 TEST KITS FOR METERS AND GAUGES

A. Test kits for meters and gages shall be provided to the Owner new and in good condition. Previously used kits will be unacceptable. Kits shall be submitted prior to the Acceptance Phase. Kits included shall be as a minimum:

1. Digital indication of temperature and pressure with associated sensors to work with the P/T test ports.
2. Companion readout kit (with fittings) for calibrated balancing valve with ranges as required by all devices on this project.

2.03 TAB & COMMISSIONING PORTABLE OPERATOR TERMNALS

A. Provide the CA with all software, connection devices, licenses, passwords, etc. to facilitate connection to the BAS throughout the building. Provide a license to graphic software, and all operating software necessary for testing and configuration of all control elements at all levels. License may be a temporary license that will expire after the completion of the Warranty Period. Options include:

1. A laptop computer provided by BAS Contractor for dedicated use by the CA throughout the Construction and Acceptance Phases. This would be turned over to the Owner at the end of the Acceptance Phase.

2. Browser access to the full graphic software: CA will provide laptop, however BAS Contractor shall set up the laptop to successfully connect.
3. Licensed client software to be installed on CA computer: BAS Contractor shall install the software and ensure it is functional.
4. Terminal Services session access to a graphic server with licensing to allow use of all required software. BAS Contractor shall configure the CA computer to connect to the terminal session.

B. Access to the BAS must be provided throughout the building as more fully defined as follows:

1. Full wireless connection to the graphic server throughout the building will be adequate.
2. Network connection for full access to the graphic server within 50' of any point in the building.
3. Exception to 1 and 2 above: An acceptable alternative to full building access to the graphic server relating to terminal unit controls shall be providing to the CA the devices and software required to connect to local terminal unit controllers through a connection port in the space such as connection to a jack on the temperature sensor (basically what is required by TAB specified below). This does not apply to mechanical rooms as full graphic access is required in mechanical rooms.

C. Provide software required by TAB to calibrate all flow sensors. TAB will provide computer to be used as a portable operator's terminal. Any manufacturer specific hardware such as connection cables, converters, handheld devices, etc. shall be provided by the BAS Contractor.

D. Connections shall be provided local to the device being calibrated. For instance, for VAV boxes, connection of the operator's terminal shall be either at the sensor as well as at the box. Otherwise a wireless system shall be provided to facilitate this local functionality.

PART 3 - EXECUTION

3.01 BAS STARTUP TESTING, ADJUSTING, CALIBRATION

A. BAS work and/or systems shall be fully functioning prior to Demonstration and Acceptance Phase. Contractor shall start, test, adjust, and calibrate all work and/or systems under this contract, as described below:

1. Inspect the installation of all devices. Review the manufacturer's installation instructions and validate that the device is installed in accordance with them.
2. Verify proper electrical voltages and amperages, and verify that all circuits are free from faults.
3. Verify integrity/safety of all electrical connections.
4. For the following control settings, initially use the control setting that was used by the existing BAS unless otherwise indicated. For AHUs that use a throttled outside air damper position when minimum outside air is required, Contractor shall mark existing minimum outside air damper position to allow replication by new BAS installation.
5. Coordinate with TAB Contractor to obtain and, with CA, fine tune control settings that are determined from balancing procedures. Record the following control settings as obtained from TAB Contractor, and note any TAB deficiencies in the BAS Start-Up Documentation:

    a. Optimum duct static pressure setpoints for VAV air handling units.
    b. Minimum outside air damper settings for air handling units.
    c. Optimum differential pressure setpoints for variable speed pumping systems.

d. Calibration parameters for flow control devices such as VAV boxes and flow measuring stations. BAS Contractor shall provide hand held device as a minimum to the TAB and CA to facilitate calibration. Connection for any given device shall be local to the device (i.e., at the VAV box or at the thermostat). HHD or POT shall allow querying and editing of parameters required for proper calibration and Start-Up.
e. Calibration parameters for fume hoods.

6. Test, calibrate, and set all digital and analog sensing and actuating devices. Calibrate each instrumentation device by making a comparison between the BAS display and the reading at the device, using an instrument traceable to the National Bureau of Standards, which shall be at least twice as accurate as the device to be calibrated (e.g., if field device is +/-0.5% accurate, test equipment shall be +/-0.25% accurate over same range). Record the measured value and displayed value for each device in the BAS Start-Up Documentation.
7. Check and set zero and span adjustments for all transducers and transmitters.
8. For dampers and valves:

a. Check for adequate installation including free travel throughout range and adequate seal.
b. Where control loops are sequenced, check for proper control without overlap of controlled devices.

9. For actuators:

a. Check to ensure that device seals tightly when the appropriate signal is applied to the operator.
b. Check for appropriate fail position, and that the stroke and range is as required and coordinated with the programmed ranges when it is operating under normal conditions.
c. For pneumatic operators, adjust the operator spring compression as required to achieve close off. If positioner or volume booster is installed on the operator, calibrate per manufacturer's procedure to achieve spring range indicated. Check split range positioners to verify proper operation. Record settings for each device.
d. Check the stroke and range under actual loading conditions and validate that they correlate with programmed values.
e. For sequenced electronic actuators, calibrate per manufacturer's instructions to required ranges.

10. Check each digital control point by making a comparison between the control command at the CU and the status of the controlled device. Check each digital input point by making a comparison of the state of the sensing device and the OI display. Record the results for each device.
11. For outputs to reset other manufacturers devices (such as VSDs) and feedback from them, calibrate ranges to establish proper parameters. Coordinate with representative of the respective manufacturer and obtain their approval of the installation.
12. Verify proper sequences by using the approved Start-Up Documentation to record results. Verify proper sequence and operation of all specified functions.
13. Verify that all safety devices trip at appropriate conditions. Adjust setpoints accordingly.
14. Tune all control loops to obtain the fastest stable response without hunting, offset or overshoot. Record tuning parameters and response test results for each control loop in the BAS Start-Up Documentation. Except from a start-up, maximum allowable variance from setpoint for controlled variables under normal load fluctuations shall be as follows. Within 3 minutes of any step-change (for which the system has the capability to respond) in the control loop, the following tolerances shall be maintained (exceptions noted):

a. Duct air temperature: ±1ºF.

b. Zone temperature: ±3ºF within 3 minutes and control within ±2ºF.
c. Chilled water temperatures: ±1ºF.
d. Hot water temperatures: ±2ºF.
e. Duct air pressure: ± 0.25" w.g.
f. Water pressure: ±1 psid.
g. Duct relative humidity: ±3% when adding humidity.
h. Zone relative humidity: ±5% when adding humidity.
i. Terminal air flow control: ±5% of setpoint. This includes all VAV terminal control and exhausted BSCs, canopy hoods, ventilated cage racks, necropsy tables, and other scientific equipment with supply or exhaust ventilation.
j. Fume hoods: ±10% on full sash travel (from min to max in 3 seconds) within 3 seconds. ±5% when sash is positioned in the controllable range.
k. Zone pressurization (on active control systems): ±0.03" w.c. with no door or window movements. No high containment space shall go more than 0.15" w.c. positive, nor go positive at all for more than 20 seconds.

15. For communication interfaces and BAS control panels:

a. Ensure devices are properly installed with adequate clearance for maintenance and with clear labels in accordance with the record drawings.
b. Ensure that terminations are safe, secure, and labeled in accordance with the record drawings.
c. Check power supplies for proper voltage ranges and loading.
d. Ensure that wiring and tubing are run in a neat and workman-like manner, either bound or enclosed in trough.
e. Check for adequate signal strength and acceptable bandwidth utilization on communication networks.
f. Check for stand-alone performance of controllers by disconnecting the controller from the LAN. Verify the event is annunciated at Operator Interfaces. Verify that the controlling LAN reconfigures as specified in the event of a LAN disconnection.
g. Ensure that all outputs and devices fail to their proper positions/states.
h. Ensure that buffered and/or volatile information is retained through power outage.
i. With all system and communications operating normally and all trends functioning, sample and record update/annunciation times for critical alarms fed from the panel to the Operator Interface.
j. Check for adequate grounding of all BAS panels and devices.
k. Run self-diagnostic routines and ensure they are functional.
l. Check the memory allocation and loading to ensure adequate and excess capacity is available and that it will not affect control functionality.

16. Coordinate desired initial alarm strategies with Owner's Operators. Set all required alarms and document the initial settings in the Start-Up Documentation.
17. Coordinate all initial setpoints with Owner's Operators. Ensure those setpoints are active.
18. For Operator Interfaces:

a. Verify that all elements on the graphics are functional and are properly bound to physical devices and/or virtual points, and that hot links or page jumps are functional and logical.
b. Output all specified BAS reports for review and approval.
c. Verify that the alarm printing and logging is functional and per requirements.
d. Verify that trend archiving to disk and provide a sample to the CA for review.
e. Verify alarm enunciation functionality. Time delay from actual occurrence to the time updated or enunciated on the screen. Ensure it is per the specified requirements.
f. Verify that real time and historical trends are accessible and viewable in graph format.

g. Verify that paging/dial out alarm annunciation is functional.
h. Verify the functionality of remote OIs and that a robust connection can be established consistently.
i. Verify that required third party software applications required with the bid are installed and are functional.
j. Demonstrate open protocol and custom third party interfaces reliably communicate and check response time.
k. Verify response times and screen update and refresh times are per the requirements.
l. Verify that all custom programs are editable from the OI. Check upload, download, backu p and restore capabilities of system configuration information as well as custom programs.
m. Verify schedules are set up and working.
n. Verify Owner stipulated security and permissions is set up and functional.
o. In concert with the Building Power Outage test, validate that critical GUI installations are properly powered by UPS and emergency outlets to keep it functional during a power outage. Validate that the space has adequate lighting to manage the building in the event of an outage.

19. Start-up and check out control air compressors and air drying and filtering systems in accordance with the appropriate section and with manufacturer's instructions.

a. Validate adequate deliver and pressures.
b. Validate adequate redundancy.
c. Validate max run time and cycle time vs manufacturer's recommendations.
d. Validate that routing of the compressed air does not result in condensation at any point in the system when used with the specified drier.
e. Check all PRVs both primary and back up to ensure adequate functionality and maintenance of downstream pressure.

20. Verify proper interface with Fire Alarm System.
21. Verify proper interface with control panels of equipment with self-contained controls that are being monitored by the BAS.

B. Submit Start-Up Documentation. This shall be completed, submitted, and approved prior to demonstration and Acceptance Phase.

3.02 SENSOR CHECKOUT AND CALIBRATION

A. General Checkout: Verify that all sensor locations are appropriate and are away from causes of erratic operation. Verify that sensors with shielded cable are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within 0.2°F of each other for temperature and within a tolerance equal to 2% of the reading of each other for pressure. Tolerances for critical applications may be tighter.

B. Calibration: Calibrate all sensors using one of the following procedures:

1. Sensors Without Transmitters--Standard Application. Make a reading with a calibrated test instrument within 6 inches of the site sensor at various points across the range. Verify that the sensor reading (via the permanent thermostat, gage or BAS) is within the tolerances specified for the sensor. If not, adjust offset and range, or replace sensor. Where sensors are subject to wide variations in the sensed variable, calibrate sensor within the highest and lowest 20% of the expected range.

2. Sensors With Transmitters--Standard Application. Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data, simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the OI. Record all values and recalibrate controller as necessary to conform to tolerances. Reconnect sensor. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or BAS) is within the tolerances specified. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.

C. Sensor Tolerance: Sensors shall be within the tolerances specified for the device.

3.03 COIL VAVE LEAK CHECK

A. Verify proper close off of the valves. Ensure the valve seats properly by simulating the maximum anticipated pressure difference across the circuit. Calibrate air temperature sensors on each side of coil to be within 0.5°F of each other. Via the OI, command the valve to close. Energize fans. After 5 minutes, observe air temperature difference across coil. If a temperature difference is indicated, and the piping surface temperature entering the coil is within 3°F of the water supply temp, leakage is probably occurring. If it appears that it is occurring, close the isolation valves to the coil to ensure the conditions change. If they do, this validates the valve is not closing. Remedy the condition by adjusting the stroke and range, increasing the actuator size/torque, replacing the seat, or replacing the valve as applicable.

3.04 VALVE STROKE SETUP AND CHECK

A. For all valve and actuator positions checked, verify the actual position against the OI readout.

B. Set pumps to normal operating mode. Command valve closed, verify that valve is closed, and adjust output zero signal as required. Command valve open, verify position is full open and adjust output signal as required. Command valve to a few intermediate positions. If actual valve position doesn't reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

3.05 ALARM SETPOINT COORDINATION

A. The Contractor shall prepare a Controls Parameter Matrix of all conceptual point types and recommend the types and recommended alarming strategies and setpoint for review of CA and Owner. Owner shall use this alarm list to provide direction to Contractor for alarm strategies and setpoints. Alarm list shall be provided at least two months prior to the first functional test. Contractor shall have alarm setpoints entered prior to functional testing. Omitting an alarm setting, using the wrong strategy, or entering the wrong setpoints will be considered a failure from the perspective of the functional test.

3.06 GRAPHIC COORDINATION

A. The Contractor shall prepare all graphics (only one example graphic is required for typical systems like terminal units) with points embedded for review of CA and Owner. Owner shall use these graphics to provide direction to Contractor for the required final graphic. All final graphics must be

complete and active before functional testing. Any deviation from the approved graphics will be considered a failure from the perspective of the functional test.

3.07 BAS DEMONSTRATION

A. Demonstration will occur while the project BAS is connected to the QA Construction BAS.

B. Demonstrate the operation of the BAS hardware, software, and all related components and systems to the satisfaction of the CA and Owner. Schedule the demonstration with the Owner's representative 1 week in advance. Demonstration shall not be scheduled until all hardware and software submittals, and the Start-Up Test Report are approved. If the Work fails to be demonstrated to conform with Contract specifications, so as to require scheduling of additional site visits by the CA for re-demonstration, Contractor shall reimburse Owner for costs of subsequent CA site visits.

C. The Contractor shall supply all personnel and equipment for the demonstration, including, but not limited to, instruments, ladders, etc. Contractor supplied personnel must be competent with and knowledgeable of all project-specific hardware, software, and the HVAC systems. All training documentation and submittals shall be at the job site.

D. Demonstration shall typically involve small representative samples of systems/equipment randomly selected by the Owner and CA.

E. The system shall be demonstrated following the same procedures used in the Start-Up Test by using the approved Commissioning Checklists. Demonstration shall include, but not necessarily be limited to, the following:

1. Demonstrate that required software is installed on BAS workstations. Demonstrate that graphic screens, alarms, trends, and reports are installed as submitted and approved.
2. Demonstrate that points specified and shown can be interrogated and/or commanded (as applicable) from all workstations, as specified.
3. Demonstrate that remote dial-up communication abilities are in accordance with these Specifications.
4. Demonstrate correct calibration of input/output devices using the same methods specified for the start-Up tests. A maximum of 10 percent of I/O points shall be selected at random by CA and/or Owner for demonstration. Upon failure of any device to meet the specified end-to-end accuracy, an additional 10 percent of I/O points shall be selected at random by CA for demonstration. This process shall be repeated until 100 percent of randomly selected I/O points have been demonstrated to meet specified end-to-end accuracy.
5. Demonstrate that all BAS and other software programs exist at respective field panels. The BAS programming and point database shall be as submitted and approved.
6. Demonstrate that all BAS programs accomplish the specified sequences of operation.
7. Demonstrate that the panels automatically recover from power failures, as specified.
8. Demonstrate that the stand-alone operation of panels meets the requirements of these Specifications. Demonstrate that the panels' response to LAN communication failures meets the requirements of these Specifications.
9. Identify access to equipment selected by CA. Demonstrate that access is sufficient to perform required maintenance.
10. Demonstrate that required trend graphs and trend logs are set up per the requirements. Provide a sample of the data archive. Indicate the file names and locations.

F. BAS Demonstration shall be completed and approved prior to Functional Performance Testing. CA shall determine if the system is ready for Functional Performance Testing and document any problems requiring Contractor attention.

1. If the systems are not ready for Functional Performance Testing, Contractor shall correct problems and provide notification to the Owner's representative that all problems have been corrected. The Acceptance Period shall be restarted at a mutually scheduled time for an additional one week period. This process shall be repeated until CA issues notice that the BAS is ready for Functional Performance Testing.

G. Any tests successfully completed during the BAS Demonstration will be recorded as 'Passed' for the Functional Performance Testing and will not have to be re-accomplished.

3.08 BAS ACCEPTANCE PHASE AND OBSERVATION PERIOD

A. BAS Acceptance Phase: BAS Acceptance Phase consists of the Functional Performance Testing process of the BAS by the CA and shall begin after approval of the BAS Demonstration and prior to issuance of Substantial Completion. Acceptance Phase for the BAS shall not be scheduled until all HVAC systems are in operation, the Start-Up Documentation has been reviewed, all required cleaning and lubrication has been completed (i.e., filters changed, piping flushed, strainers cleaned, etc.), and TAB report has been submitted and approved. Acceptance Phase and its approval to begin will be performed on a system-by-system basis if mutually agreed upon by Contractor and Owner.

B. BAS Observation Period: Prior to beginning Functional Performance Testing, the BAS shall be shown to operate properly for 2 weeks without malfunction, without alarm caused by control action or device failure, and with smooth and stable control of systems and equipment in conformance with these specifications. At the end of the two weeks, BAS Contractor shall forward the trend logs to the CA for review.

C. During the Acceptance Phase, the Contractor shall maintain a hard copy log of all alarms generated by the BAS. For each alarm received, Contractor shall diagnose the cause of the alarm, and shall list on the log for each alarm, the diagnosed cause of the alarm, and the corrective action taken. If in the Contractor's opinion, the cause of the alarm is not the responsibility of the Contractor, Contractor shall immediately notify the Owner's representative.

D. During the Acceptance Phase, the Contractor shall maintain all controller network and workstation hardware and software in a state that will allow remote access by CA to trend logs as specified below.

3.09 BAS TREND COMMISSIONING REQUIREMENTS

A. CA will analyze trend logs of the system operating parameters to evaluate normal system functionality. The requirements of the trending are specified below. Contractor shall establish these trends, ensure they are being stored properly, and forward the data in electronic format to the CA.

B. Data shall include a single row of field headings and the data thereafter shall be contiguous. Each record shall include a date and time field. Recorded parameters for a given piece of equipment or component shall be trended at the same time intervals and be presented in a maximum of two separate two dimensional formats with time being the vertical axis and field name being the horizontal axis. Data shall be forwarded in one of the following formats.

1. Microsoft Excel Spreadsheet (.xls).
2. Comma Separated Value (.csv).

C. Sample times indicated as COV mean that the changed parameter only needs to be recorded whenever the value changes by the amount listed. When output to the trend file, the latest recorded

value shall be listed along with the time increment record. If the BAS does not have the capability to record based on COV, the parameter shall be recorded based on the time interval common to other point trends for the system.

D. Contractor shall provide the CA with required passwords, phone numbers, etc. to allow the CA access to the trend log data and allow downloading to a remote location. Contractor shall also provide step-by-step written instructions for accessing the data.

E. Trending used to document ongoing FPTs may occur and be at a more frequent interval. Consult with the CA to determine the required intervals for functional testing and modify intervals as required.

3.10 TREND GRAPHS

A. Trend graphs shall be used during Functional Performance Testing to facilitate and document testing. Contractor shall prepare controller and workstation software to display graphical format trends throughout the Acceptance Phase. Trend graphs shall demonstrate compliance with contract documents. Trended values and intervals shall be the same as those specified for the Functional Performance Tests.

B. Lines shall be labeled and shall be distinguishable from each other by using either different line types or different line colors.

C. Indicate engineering units of the y-axis values; e.g. degrees F., inches w.c., Btu/lb, percent wide open, etc.

D. The y-axis scale shall be chosen so that all trended values are in a readable range. Do not mix trended values on one graph if their unit ranges are incompatible.

E. Trend outside air temperature, humidity, dew point and enthalpy during each period in which any other points are trended.

F. All points trended for one HVAC subsystem (e.g. air handling unit, chilled water system, etc.) shall be trended simultaneously and on a common trend period.

G. Each graph shall be clearly labeled with HVAC subsystem title, date, and times.

3.11 WARRANTY PHASE – OPPOSITE SEASON TRENDING AND TESTING

A. Warranty Period shall not commence until successful completion of the BAS Demonstration.

B. Trending: Throughout the Warranty Phase, trend logs shall be maintained as required for the Acceptance Phase. BAS Contractor shall forward archived trend logs to the CA for review upon CA request. CA will review these and notify BAS Contractor of any warranty work required.

C. Opposite Season Testing: Within 6 months of completion of the Acceptance Phase, CA shall schedule and conduct Opposite Season Functional Performance Testing. The BAS Contractor shall support this testing and remedy any deficiencies identified.

D. End of Warranty Visit: CA/PU will conduct an End of Warranty walkthrough a minimum of one month prior to the end of the Warranty Period. Contractor shall participate in this walkthrough and remedy any deficiencies identified.

3.12 SOFTWARE OPTIMIZATION ASSITANCE

A. The Contractor shall provide the services of a BAS technician as specified above at the project site to be at the disposal of the CA. The purpose of this requirement is to make changes, enhancements, and additions to control unit and/or workstation software that have been identified by the CA during the construction and commissioning of the project and that are beyond the specified Contract requirements. The cost for this service shall be included with the bid as noted above. Requests for assistance shall be for contiguous or non-contiguous 8-hour days, unless otherwise mutually agreed upon by Contractor, CA, and Owner. The Owner's representative shall notify Contractor 2 days in advance of each day of requested assistance.

B. The BAS technician provided shall be thoroughly trained in the programming and operation of the controller and workstation software. If the BAS technician provided cannot perform every software task requested by the CA in a timely fashion, Contractor shall provide additional qualified personnel at the project site as requested by the CA to meet the total specified requirement [per building] on-site.

3.13 BAS OPERATOR TRAINING

A. Provide up to 6 complete sets of User Manuals (hard copy and one electronic copy) to be used for training.

B. BAS Contractor shall submit a Training Plan per the requirements of Div. 01 to the [Owner] who will forward it to the A/E and CA for review.

C. On Site Training: Provide services of BAS Contractor's qualified technical personnel for two 8- hour days to instruct Owners personnel in operation and maintenance of the BAS. Instruction shall be in classroom setting at the project site for appropriate portions of the training. Training may be in non-contiguous days at the request of the Owner. The Owner's representative shall notify Contractor 1-week in advance of each day of requested training. The Contractor's designated training personnel shall meet with the A/E, CA, and Owner's representative for the purpose of discussing and fine-tuning the training agenda prior to the first training session. Training agenda shall be as follows:

1. Basic Operator Workstation Training – 8 hours for all potential users of the OWS in 4-hour non-contiguous segments:

    a. Brief walk-through of building, including identification of all controlled equipment and condensed demonstration of controller portable and built-in operator interface device display capabilities.
    b. Brief overview of the various parts of the BAS O&M manuals, including hardware and software programming and operating publications, catalog data, controls installation drawings, and BAS programming documentation.
    c. Demonstration of workstation login/logout procedures, password setup, and exception reporting.
    d. Demonstration of workstation menu penetration and broad overview of the various workstation features.
    e. Overview of systems installed.
    f. Present all site-specific naming conventions and points lists, open protocol information, configuration databases, back up sequences, upload/download procedures, etc.
    g. Overview of scheduling procedures.
    h. Overview of alarm features, including how to acknowledge, respond to, and archive alarms, and how to access further information from them.

i. Overview of trend features, including how to set up and view trends.
j. Overview of workstation reporting features and introductory level report generation and scheduling.

2. BAS Technician Training: Two 24-hour training sessions that can be in 4-hour non-contiguous segments for individuals who will troubleshoot the system hardware, I/O devices, and the systems in general.

a. General review of sequence of operation and control logic for the project site, including standalone and fail safe modes of operation.
b. Uploading/downloading and backing up controller configuration and application programs.
c. Review of installed components including all communication devices, controllers, I/O, etc., and how to install/replace, maintain, commission, and diagnose them.
d. Introduction to controller programming and overview of the programming application interface.
e. Defining trends, generating graphs in real time; archiving trends, accessing historical archive, and generating reports from them.
f. Introductory network administration.
g. Introduction to creating and editing graphics.
h. Review of setpoint optimization and fine-tuning concepts.
i. OI use and maintenance.
j. Web page creation as applicable.

3. System Administrator Training: One 8-hour session that may be done in two 4-hour segments on non-contiguous days. Target audience is the person who will be maintaining the system from an IT perspective as well as Owners IT personnel. Agenda shall be as follows:

a. Overview of system architecture including all routers, bridges, repeaters, gateways, communications protocols, servers, controllers, etc.
b. Overview of and recommendations for backing up and restoring the system configuration database.
c. Server maintenance.
d. Security Management: Assigning passwords and rights for various users on the server, workstations, and GUI software.

4. Final Systems Operation Training.

a. The BAS Contractor shall conduct Final Systems Operation Training in accordance with all specifications.
b. Final Systems Operation Training provides the Owner and Operators a training session on whole-building operation. It shall focus primarily on BAS control of building systems and operation and its impact on building performance. System interactions shall be presented and discussed (such as a combined air handler, chiller, boiler, and terminal unit system), along with a detailed presentation of the sequences of operation and their relationship to the BAS. This training shall be conducted by the BAC with assistance from the CA, and shall be attended by the Owner, Operators, Contractor, Design Team, and by any other Cx Team members deemed necessary by the CA or the Owner.
c. The Record BAS Shop Drawings shall be provided as a handout for the training.
d. Scheduling, attendees, and training methods shall be as specified in Section 25 55 00 and any general commissioning requirements.

5. Third Party Equipment Controls Training.

a. The vendor for Third Party Equipment controls shall present a session to occupant representatives on how the equipment controls work.
b. The audience for this session shall be the occupants and their representatives. The setting should be in the field at the equipment.

END OF SECTION 250800

SECTION 260090 – ELECTRICAL SYSTEM COMMISSIONING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Systems and equipment Start-Up and Functional Performance Testing.

B. Validation of proper and thorough installation of Division 26 systems and equipment.

C. Generic Startup Documentation for mechanical systems and equipment.

D. Development of final Startup Documentation for mechanical systems and equipment.

E. System Startup and Turn-Over procedures.

F. Coordination and execution of Training Events.

1.02 GENERAL DESCRIPTION

A. Commissioning (Cx) is the process of ensuring that (i) all building systems are installed and perform interactively according to the design intent; (ii) that systems are efficient and cost effective and meet the Owner's operational needs; (iii) that the installation is accurately documented; and (iv) that the Operators are adequately trained. Commissioning serves as a tool to minimize post- occupancy operational problems, and establishes testing and communication protocols to advance the building systems from installation to optimized, fully-dynamic operation.

B. Commissioning Authority (CA) shall work with the Contractor and the design engineers to direct and oversee the Cx process and perform Functional Performance Testing.

C. The Commissioning Plan outlines the Cx process beyond the Construction Contract, including design phase activities and design team/owner responsibilities. The specification Sections dictate all requirements of the commissioning process relative to the construction contract. The Cx Plan is not part of the construction contract, although it is available for reference at the request of the Contractor.

D. This Section outlines the Cx procedures specific to the Division 23 Contractors. Requirements common to all Sections are specified in Section 019100 and Section 019110. This Section and other sections of the specification details the Contractor's responsibilities relative to the Cx process.

1.03 SCOPE

A. Electrical Systems: All Division 26 equipment and systems are subject to commissioning, including but not limited to the systems listed below. All components and devices that make up these systems are included.

1. Medium Voltage Feeders and Primary Service Feeders.
2. Medium Voltage Disconnect & Grounding Switches.
3. Medium Voltage Interior Transformers.
4. Grounding Equipment and Building Grounding System.

5. Switchgear/Switchboards.
6. Disconnect Switches.
7. Circuit Breakers.
8. Distribution Dry-Type Transformers.
9. Distribution and Branch Circuit Panelboards.
10. Busways.
11. Feeders and Large Branch Circuits.
12. Branch Circuits and Receptacles.
13. Lighting and Lighting Controls.
14. Uninterruptible Power Systems (UPS).
15. Motors.
16. Electric Distribution Power Monitoring System.
17. Commissioning coordination with Division 23 Requirements for BAS Integration.

1.04 RELATED WORK AND DOCUMENTS

A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this specification and shall be used in conjunction with this section as part of the contract documents. See Division 01 for details.

B. The Cx process references many related Sections, particularly Section 019100 - General Commissioning Requirements. It is important for all Contractors subject to the Cx process to be familiar with Section 019100.

C. Section 019110 – General Commissioning Requirements for Functional Performance Testing.

D. Section 220800 – Plumbing System Commissioning.

E. Section 230800 – HVAC System Commissioning.

F. Section 238060 – BAS Commissioning.

1.05 DEFINITIONS AND ABBREVIATIONS

A. Refer to Section 019100 for a complete list of Definitions and Abbreviations.

1.06 REFERENCE STANDARDS

A. Refer to Section 019100 for a complete list of Definitions and Abbreviations.

B. ASHRAE Standard 202 – Commissioning Process for Buildings and Systems.

C. ASHRAE Guideline 0 – The Commissioning Process.

D. ASHRAE Guideline 1.1 – HVAC&R Technical Requirements for the Commissioning Process.

E. ASHRAE Guideline 1.3 – Building Operations and Maintenance Training for the HVAC&R Commissioning Process.

F. ASHRAE Guideline 1.4 – Procedures for Preparing Facility Systems Manual.

G. National Electric Code (NEC).

H. American Society for Testing and Materials (ASTM).

I. Electronics Industry Association/Telecommunications Industry Association (EIA/TIA).

J. Illuminating Engineering Society (IES).

K. Institute of Electrical and Electronics Engineers (IEEE).

L. International Electrical Testing Association (NETA).

M. National Electrical Manufacturers Associates (NEMA).

N. National Fire Protection Association (NFPA).

O. Underwriters Laboratory, Inc. (UL).

P. Refer to Section 019100 for additional Reference Standards.

1.07 DOCUMENTATION

A. Documentation shall be as required in Section 019100. In addition, Contractor shall also provide to the CA the following per the procedures specified herein, in the Cx Plan, and in other Sections of the specification:

1. Short Circuit and Coordination Study: CA shall review and recommend approval.
2. Factory Test Reports: Contractor shall provide any factory testing documentation or certified test reports required by the specifications. These shall be provided prior to Acceptance Phase. Factory Test Reports shall be provided in PDF electronic format. These include but are not limited to:

    a. Enter any factory tested equipment.

3. Field Testing Agency Reports: Provide all documentation of work of independent testing agencies required by the specification. These shall be provided prior to Acceptance Phase. Field Testing Agency Reports should be provided in PDF electronic format. These may include but are not limited to:

    a. Electrical Testing Agency Reports per Division 26.
    b. Thermographic Survey Report.
    c. Generator Load Testing.
    d. Other.

4. Sample of distribution panel and receptacle labeling for approval.
5. Fire Alarm System Approvals and Certifications.

1.08 SEQUENCING AND SCHEDULING

A. Refer to Section 019100.

1.09 COORDINATION MANAGEMENT PROTOCOLS

A. Coordination responsibilities and management protocols relative to Cx are initially defined in Section 019100 and the Cx Plan, but shall be refined and documented in the Construction Phase Cx Kick-Off Meeting. Contractor shall have input into the protocols to be used and all Parties will commit to scheduling obligations. The CA will record and distribute.

1.10 CONTRACTOR RESPONSIBILITIES

A. Refer to Section 019100: Detailed Contractor responsibilities common to all Divisions are specified in Section 019100. The following are additional responsibilities or notable responsibilities specific to Division 26.

B. Construction Phase.

1. Provide skilled technicians qualified to perform the work required.
2. Provide factory-trained and authorized technicians where required by the Contract Documents.
3. Prepare and submit required draft Startup Documentation and submit along with the manufacturer's application, installation, and startup information.
4. Provide assistance to the CA in preparation of the specific Functional Performance Test (FPT) procedures. Contractors, subcontractors and vendors shall review FPT procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests. Damage caused to equipment performed in accordance with the approved procedures will be the responsibility of the Contractor.
5. Thoroughly complete and inspect installation of systems and equipment as detailed throughout Contract Documents, as required by reference or industry standards, and as specifically indicated elsewhere this Section.
6. Startup, test/adjust/balance, and Turn-Over systems and equipment prior to functional performance testing by the CA. Approved Startup Documentation shall be in accordance with Contract Documents, reference or industry standards, and specifically elsewhere in Part I of this Section.
7. Record Startup on approved Startup Documentation forms and certify that the systems and equipment have been started and or tested in accordance with the requirements specified above. Each task or item shall be indicated with the Party actually performing the task or procedure.
8. Coordinate the work of the Electrical Testing Agency and the Cx requirements.

C. Acceptance Phase.

1. Assist CA in Functional Performance Testing. Assistance will typically include the following:

    a. Manipulate systems and equipment to facilitate Functional Performance Testing (as specified in Section 019100, Section 019110, and the Cx Plan; in some cases this will entail only an initial sample).
    b. Provide any specialized instrumentation necessary for Functional Performance Testing.

D. Warranty Phase.

1. Maintain record documentation of any configurations, setpoints, parameters, etc. that change throughout the Warranty Period.
2. Provide representative for off-season testing as required by CA.
3. Respond to warranty issues as required by Division 01 and the General Conditions.

1.11 EQUIPMENT SUPPLIER RESPONSIBILITIES

A. Refer to Section 019100.

1.12 CONTRACTOR NOTIFICATION AND SCHEDULING

A. Refer to Section 019100.

1.13 STARTUP DOCUMENTATION

A. Refer to Section 019100.

1.14 EQUIPMENT NAMEPLATE DATA

A. Refer to Section 019100.

1.15 FUNCTIONAL PERFORMANCE TESTING

A. For applicable systems and equipment, Contractor shall participate in the initial samples of Functional Performance Testing as stipulated in Section 019100 and Section 019110.

1.16 FPT ACCEPTANCE CRITERIA

A. Acceptance criteria for tests are indicated in Section 01 91 10 and in the specification Sections applicable to the systems being tested. Unless indicated otherwise, the criteria for acceptance will be that specified with the individual system, equipment, component, or device, which shall typically conform to NFPA 70B and International Electrical Testing Association (NETA) testing specifications NETA ATS-1991.

1.17 TRAINING EVENTS AND TRAINING PLAN

A. Contractors, subcontractor, vendors, and other applicable Parties shall prepare and conduct training sessions on the installed systems and equipment they are responsible for per the requirements of Section 019100 and the individual Specifications.

1.18 SYSTEMS MANUAL AND O&M DOCUMENTATION CONTENT

A. Refer to Section 019100.

PART 2 - PRODUCTS

2.01 INSTRUMENTATION

A. General: All testing equipment used by any Party shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. Unless otherwise noted, all

equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.

B. Testing Instrumentation: Contractor shall provide all instrumentation necessary for tests for which they are responsible. CA will provide standard instrumentation for measuring medium and low voltage electrical voltage, current, power factor, power, and total harmonic distortion (THD). CA will provide receptacle testers for normal and GFI receptacle tests. Contractor shall provide all other instrumentation required to accomplish the specified testing.

PART 3 - EXECUTION

3.01 GENERAL STARTUP DOCUMENTATION

A. This Section outlines 'generic' or minimally acceptable Startup Documentation (which are defined to include both 'Startup Checks' and 'Startup Tests') and individual systems training requirements for systems and equipment. These procedures are the direct responsibility of the Contractor as a basic element of validating that the installation is correct per normal quality control practices. These items shall provide a minimally acceptable guideline for required Contractor development of Startup Documentation. Contractor shall synthesize these minimum requirements along with their own internal quality control practices, those of the manufacturer, and any applicable codes and standards to develop specific and itemized final Startup Documentation specific to the equipment and systems installed on this project.

B. Section 019100 defines the systems and equipment Startup process in detail and provides definitions for Startup Documentation, including the generic Startup Documentation provided below.

C. Refer to Division 26 for additional details regarding the Electrical Testing required.

3.02 STARTUP DOCUMENTATION COMMON TO ALL SYSTEMS

A. The following Startup Documentation (Checklists and Tests) shall be considered common to all systems:

1. Checkout shall proceed from lower level devices to larger components to the entire system operation.
2. Verify labeling is affixed per specification and visible.
3. Verify prerequisite procedures are done.
4. Inspect for damage and ensure none is present.
5. Verify system is installed per the manufacturer's recommendations.
6. Verify system has undergone Startup per the manufacturer's recommendations.
7. Verify that access is provided for inspection, operation, and repair.
8. Verify that access is provided for eventual replacement of the equipment.
9. Verify that record drawings, submittal data and O&M documentation accurately reflect the installed systems.
10. Verify all gauges and test ports are provided as required by contract documents and manufacturer's recommendations.
11. Verify all recorded nameplate data is accurate.
12. Verify that the installation ensures safe operation and maintenance.
13. Verify specified replacement material/attic stock has been provided as required by the Contract Documents.
14. Verify all rotating and moving parts are properly lubricated.

15. Verify all monitoring and ensure all alarms are active and set per Owner's requirements.
16. Complete all nameplate data and confirm that ratings conform to the design documents.

3.03 TESTING PROCEDURES

A. Thermographic Scanning.

1. The infrared scan shall be made when the equipment is energized and is operating at its normal capacity, unless otherwise noted. It is intended that the scan be made after the equipment has been in full operation; however, the exact time of conducting the scan will be determined by the CA near the completion of the project.
2. Test equipment, miscellaneous tools, and materials shall be transported properly, moved, and set up by trained personnel. Equipment used in testing shall be capable to perform all recommended procedures required by the apparatus and related equipment. All test equipment shall have certification of calibration and be in working order.
3. All hot spots shall be marked, identified and an infrared thermographic scanning report prepared and furnished to the Owner.
4. The report shall contain infrared photos of trouble spots with temperature readings.
5. All sources indicating heat problems shall be promptly reported to the Owner for corrective action by the Division 26 contractor.

B. Grounding Systems.

1. Perform three-point fall-of-potential test per IEEE Standard 81 on the main grounding electrode or system. Resistance shall be no greater than 5 ohms.
2. Perform the two-point method test per IEEE Standard 81 to determine the ground resistance between the main ground system and all major electrical equipment frames, system neutral, and/or derived neutral points. Resistance shall be no greater than 5 ohms.

3.04 MEDIUM VOLTAGE FEEDERS AND PRIMARY SERVICE FEEDERS

A. Include all applicable 'Start-Up Checks Common to All Systems". Additional Start-Up Checks and Tests are as follows.

B. General: Refer to the quality control requirements listed in applicable sections of Division 26 for additional checks and tests. These shall be included in the Start-Up Checks and Tests used for this project.

C. Start-Up Checks: During start-up, perform the following checks and any additional checks specified in manufacturer's instructions:

1. Inspect underground duct banks.
2. Inspect cable and perform field testing on reels.
3. Inspect splicing and terminations.
4. Verify that all phase, neutral, and ground conductors are routed together in raceways and properly grouped within switchgear to minimize heating.
5. Visually and mechanically inspect to include the following: Exposed cable, compression type terminations, splices, and fire proofing in manholes, cable vaults, etc.
6. Correct identification and phasing arrangements.

D. Start-Up Tests: During start-up, perform the following tests, measurements, or procedures and any additional tests, measurements, or procedures specified in manufacturer's instructions:

1. Inspect cable support and terminations. Inspect cables for physical damage and connections as per the single-line diagram. Ensure equipment edges are not in contact with cables or that protective padding is provided. Verify cable size, type, identification, and ratings match specifications and single-line diagram. Verify correct over-current protection.
2. Check visible cable bends against ICEA and manufacturer's minimum allowable bending radius.
3. Verify that neutrals and grounds are properly terminated for normal operation of protective devices.
4. Perform insulation resistance tests on each cable with respect to ground and adjacent cables.
5. Perform shield-continuity tests on each power cable by ohmmeter method.
6. Perform acceptance test on cables in accordance with NETA 7.3.3.2.4.

3.05 MEDIUM VOLTAGE DISCONNECT / GROUNDING SWITCHES

A. Include all applicable 'Start-Up Checks Common to All Systems". Additional Start-Up Checks and Tests are as follows.

B. General: Refer to the quality control requirements listed in applicable sections of Division 26 for additional checks and tests. These shall be included in the Start-Up Checks and Tests used for this project. For switches that contain medium voltage circuit breakers, provide the services of a factory-authorized Service Representative to supervise the installation, make adjustments, perform tests on the breakers and train Owner's maintenance personnel.

C. Start-Up Checks: During start-up, perform the following checks and any additional checks specified in manufacturer's instructions:

1. Visual and Mechanical Inspections listed in NETA 7.5.1.2.1.
2. Visual and Mechanical Inspections listed in NETA 7.6.1.3.2 (MV circuit breakers).
3. Inspect incoming power cable terminations.

    a. Verify voltage source is correct for cubicle space heater.

D. Start-Up Tests: During start-up, perform the following tests, measurements, or procedures and any additional tests, measurements, or procedures specified in manufacturer's instructions.

1. Visually and mechanically inspect to include the following: anchoring, grounding, oil level, torque of bus and cable connections, and mechanical operation of switch and operating mechanisms.
2. Electrical Tests listed in NETA 7.5.1.2.2.
3. Electrical tests listed in NETA 7.6.1.3.2 (MV circuit breakers). Optional tests are not required.

E. Training: Train Owner's maintenance personnel on procedures and schedules related to troubleshooting, servicing, and preventative maintenance.

3.06 MEDIUM VOLTAGE DRY-TYPE INTERIOR TRANSFORMERS

A. Include all applicable 'Start-Up Checks Common to All Systems". Additional Start-Up Checks and Tests are as follows.

B. General: Refer to the quality control requirements listed in applicable sections of Division 26 for additional checks and tests. These shall be included in the Start-Up Checks and Tests used for this project.

C. Start-Up Checks: During start-up, perform the following checks and any additional checks specified in manufacturer's instructions.

1. Visual and Mechanical Inspections listed in NETA 7.2.1.2.1.

D. Start-Up Tests: During start-up, perform the following tests, measurements, or procedures and any additional tests, measurements, or procedures specified in manufacturer's instructions.

1. Visually and mechanically inspect to include the following: anchoring, grounding, liquid levels, installation verification using manufacturer's checklist, torque of bus and cable connections, and tap changer operation.
2. Electrical tests listed in NETA 7.2.1.2.2. Optional tests are not required except for winding resistance test.
3. Check and confirm percent of impedance is identical for all paralleled transformers comparing nameplates.

E. Training: Train Owner's maintenance personnel on procedures and schedules related to troubleshooting, servicing, and preventative maintenance.

3.07 GROUNDING/BUILDING GROUNDING SYSTEM

A. Include all applicable 'Start-Up Checks Common to All Systems". Additional Start-Up Checks and Tests are as follows.

B. General: Refer to the quality control requirements listed in applicable sections of Division 26 for additional checks and tests. These shall be included in the Start-Up Checks and Tests used for this project.

C. Start-Up Tests**:** During start-up, perform the following tests, measurements, or procedures and any additional tests, measurements, or procedures specified in manufacturer's instructions.
1. Conduct fall of potential ground resistance tests per IEEE Standard 81 at each test well and at service equipment.
2. Perform point-to-point tests to determine the resistance between the main grounding system and all major electrical equipment frames, system neutral, and/or derived neutral points.

3.08 SWITCHGEAR AND SWITCHBOARDS

A. Include all applicable 'Start-Up Checks Common to All Systems". Additional Start-Up Checks and Tests are as follows.

B. General: Provide the services of a Factory-Trained Manufacturer's Representative to assist the Contractor in the installation and start-up service of the equipment for a period of 3 working days in 3 visits and train Owner's maintenance personnel as specified below. Refer to the quality control requirements listed in applicable sections of Division 26 for additional checks and tests. These shall be included in the Start-Up Checks and Tests used for this project.

C. Start-Up Checks: During start-up, perform the following checks and any additional checks specified in manufacturer's instructions.

1. Visual and Mechanical Inspections listed in NETA 7.1.1.
2. Check calibration/setting of trip devices using system coordination study.
3. Verify calibration/setting of digital metering.

D. Start-Up Tests: During start-up, perform the following tests, measurements, or procedures and any additional tests, measurements, or procedures specified in manufacturer's instructions.

1. Visually and mechanically inspect to include the following: anchoring; grounding; torque of feeder and incoming bus duct connections; feeder cable and integral main bus connections; switchgear section alignments; electrical clearances; mechanical operation of breaker/fuse drawout elements and operating mechanisms, manual trip function; main bus safety shutters; and installation verification using manufacturer's checklist.
2. Electrical tests listed in NETA 7.1.2. Optional tests are not required.
3. Test each breaker in accordance with the Circuit Breaker tests listed in this Section.
4. Conduct operational/functional tests of protective relaying. Time-current tests shall be conducted and trip points shall be set per the Short Circuit and Coordination Study.

E. Training: Train Owner's maintenance personnel on procedures and schedules related to troubleshooting, servicing, and preventative maintenance.

3.09 DISCONNECT SWITCHES

A. Include all applicable 'Start-Up Checks Common to All Systems". Additional Start-Up Checks and Tests are as follows.

B. General: Refer to the quality control requirements listed in applicable Sections of Division 26 for additional checks and tests. These shall be included in the Start-Up Checks and Tests used for this project.

C. Start-Up Checks: During start-up, perform the following checks and any additional checks specified in manufacturer's instructions.

1. Visual and Mechanical Inspections listed in NETA 7.5.1.1.1.
2. Check installation of warning nameplates and equipment nametags.

D. Start-Up Tests: During start-up, perform the following tests, measurements, or procedures and any additional tests, measurements, or procedures specified in manufacturer's instructions.

1. Electrical tests listed in NETA 7.5.1.1.2.

E. Training: Train Owner's maintenance personnel on procedures and schedules related to troubleshooting, servicing, and preventative maintenance.

3.10 CIRCUIT BREAKERS

A. Include all applicable 'Start-Up Checks Common to All Systems". Additional Start-Up Checks and Tests are as follows.

B. General: Provide the services of a manufacturer-certified specialist to supervise the installation, make adjustments, and perform tests on the insulated case breakers, power breakers and medium-voltage breakers and train Owner's maintenance personnel. Refer to the quality control requirements listed in applicable sections of Division 26 for additional checks and tests. These shall be included in the Start-Up Checks and Tests used for this project.

C. Start-Up Checks: During start-up, perform the following checks and any additional checks specified in manufacturer's instructions.

1. Visual and Mechanical Inspections listed in NETA 7.6.1.1.1 insulated case and molded case breakers, NETA 7.6.1.2.1 for low-voltage power breakers, and NETA 7.6.1.3.1 for medium- voltage air breakers.

D. Start-Up Tests: During start-up, perform the following tests, measurements, or procedures and any additional tests, measurements, or procedures specified in manufacturer's instructions.

1. Electrical tests listed in NETA 7.6.1.1.2 insulated case and molded case breakers, NETA 7.6.1.2.2 for low-voltage power breakers, and NETA 7.6.1.3.2 for medium-voltage air breakers. Optional tests are not required.

E. Training: Train Owner's maintenance personnel on procedures and schedules related to troubleshooting, servicing, and preventative maintenance.

3.11 MOTORS

A. Include all applicable 'Start-Up Checks Common to All Systems". Additional Start-Up Checks and Tests are as follows.

B. General: Electrical contractor shall check for adequate electrical connection for each motor. Refer to the quality control requirements listed in applicable sections of Division 26 for additional checks and tests. These shall be included in the Start-Up Checks and Tests used for this project.

C. Start-Up Checks and Tests: Follow the manufacturer's written procedures and the following as a minimum:

1. Inspect terminations and grounding.
2. Ensure proper access to all electrical equipment.
3. Ensure proper labeling of all electrical equipment.
4. Compare wiring of poles to manufacturer's instructions.
5. Check voltage-to-disconnects with disconnect open and compare to rating data.
6. In collaboration with the Contractor who supplied the motor, bump it, and ensure proper rotation.
7. Test each motor with megger and record readings. Megger test shall be performed at the final disconnect switch/breaker for the motor.
8. Check the overloads in comparison to FLA noted on the motor nameplate and ensure adequacy of protection and reliability.
9. Observe several starts to ensure the start is reliable.

3.12 DISTRIBUTION DRY-TYPE TRANSFORMERS

A. Include all applicable 'Start-Up Checks Common to All Systems". Additional Start-Up Checks and Tests are as follows.

B. General: Refer to the quality control requirements listed in applicable sections of Division 26 for additional checks and tests. These shall be included in the Start-Up Checks and Tests used for this project.

C. Start-Up Checks: During start-up, perform the following checks and any additional checks specified in manufacturer's instructions.

1. Inspect wiring connections.
2. Ensure taps are adjusted.
3. Inspect grounding.

D. Start-Up Tests: During start-up, perform the following tests, measurements, or procedures and any additional tests, measurements, or procedures specified in manufacturer's instructions.

1. Visually and mechanically inspect to include the following: mounting, grounding, electrical clearances, and K-factor and/or isolating transformers are installed where required.
2. Perform insulation resistance, turns ratios, and polarity tests on each type /size of transformer.

E. Training: Train Owner's maintenance personnel on procedures and schedules related to troubleshooting, servicing, and preventative maintenance.

3.13 DISTRIBUTION AND BRANCH CIRCUIT PANELBOARDS

A. Include all applicable 'Start-Up Checks Common to All Systems". Additional Start-Up Checks and Tests are as follows.

B. General: Refer to the quality control requirements listed in applicable sections of Division 26 for additional checks and tests. These shall be included in the Start-Up Checks and Tests used for this project.

C. Start-Up Checks: During start-up, perform the following checks and any additional checks specified in manufacturer's instructions.

1. Visually and mechanically inspect to include the following: mounting, separate ground and neutral connections per circuit, completed circuit directories, electrical clearances, KAIC ratings of panelboard and breakers.
2. Inspect wiring connections.

D. Start-Up Tests: During start-up, perform the following tests, measurements, or procedures and any additional tests, measurements, or procedures specified in manufacturer's instructions.

1. Correct surge suppression devices installed.
2. Conduct insulation resistance tests.
3. Correct identification and phasing arrangements.
4. Verify that branch circuit labeling on a minimum of 10% of the panelboard branch circuits matches the printed panelboard directory. If 25% or more of the tested branch circuits do not match the printed directory, verify another 10% of the panelboard branch circuits. If 25%, or more, of these branch circuits do not match the printed directory, verify 100% of the panelboard branch circuits.

E. Training: Train Owner's maintenance personnel on procedures and schedules related to troubleshooting, servicing, and preventative maintenance.

3.14 BUSWAYS

A. Include all applicable 'Start-Up Checks Common to All Systems". Additional Start-Up Checks and Tests are as follows.

B. General: Refer to the quality control requirements listed in applicable sections of Division 26 for additional checks and tests. These shall be included in the Start-Up Checks and Tests used for this project.

C. Start-Up Checks: During start-up, perform the following checks and any additional checks specified in manufacturer's instructions.

1. Visual and Mechanical Inspections listed in NETA 7.4.1.

D. Start-Up Tests: During start-up, perform the following tests, measurements, or procedures and any additional tests, measurements, or procedures specified in manufacturer's instructions.

1. Visually and mechanically inspect to include the following: anchoring, grounding, torque of feeder and incoming connections, electrical clearances, plug-in breakers/disconnects, and check installation using manufacturer's checklist.
2. Plug-in breakers/disconnects shall also be tested as required in the Disconnect Switch and Circuit Breaker paragraphs of this Section.
3. Electrical tests listed in NETA 7.4.2.

3.15 FEEDERS AND LARGE BRANCH CIRCUITS

A. Include all applicable 'Start-Up Checks Common to All Systems". Additional Start-Up Checks and Tests are as follows.

B. General: This paragraph and subparagraphs apply to all feeders serving panelboards, and motor control centers, all conductors connected to switchgear and switchboards, and all circuits that are rated for 100 amps, or larger. Refer to the quality control requirements listed in applicable sections of Division 26 for additional checks and tests. These shall be included in the Start-Up Checks and Tests used for this project.

C. Start-Up Checks: During start-up, perform the following checks and any additional checks specified in manufacturer's instructions.

1. Inspect cable support and terminations.
2. Verify equipment edges are not in contact with cables or that protective padding is provided.
3. Visually and mechanically inspect to include the following: large junction and pull boxes, supports of raceways and cable bus, and compression type terminations.
4. Torque test terminations and verify they are in accordance with manufacturers recommendations.
5. Correct identification and phasing arrangements.

D. Start-Up Tests: During start-up, perform the following tests, measurements, or procedures and any additional tests, measurements, or procedures specified in manufacturer's instructions.

1. Verify cable size and ratings match single-line diagram. Verify correct overcurrent protection.
2. Torque test terminations and verify they are in accordance with manufacturers recommendations.
3. Correct identification and phasing arrangements.
4. Conduct continuity test of each feeder.
5. Conduct insulation resistance test on each cable with respect to ground and adjacent cables.

3.16 LIGHTING CONTROLS

A. Include all applicable ‘Start-Up Checks Common to All Systems”. Additional Start-Up Checks and Tests are as follows.

B. General: Refer to the quality control requirements listed in applicable sections of Division 25 and 26 for additional checks and tests. These shall be included in the Start-Up Checks and Tests used for this project.

C. Start-Up Checks: During start-up, perform the following checks and any additional checks specified in manufacturer’s instructions.

1. Ensure all labeling for all relays/contactors is affixed and accurate.
2. Ensure all terminations are tight.
3. Check sensor placement is adequate for required duty.
4. Ensure adequate access is provided to all relays/contactors, timeclocks, etc.
5. Ensure all circuits for the loads are energized and ready for testing.
6. Obtain all time schedules and individual device time-delay settings for all spaces from the Owner.

D. Start-Up Tests: During start-up, perform the following tests, measurements, or procedures and any additional tests, measurements, or procedures specified in manufacturer’s instructions.

1. Test, calibrate, and set all sensing (photocells, motion sensors, etc.) devices.
2. Verify the correct operation of all control devices (contactors, relays, timeclocks, BAS interface relays, etc.).
3. Check full load current on all breakers serving controlled lighting to ensure that the breaker is properly sized.
4. Check full load current on all control device contacts serving controlled lighting to ensure that the contact rating is properly sized.
5. Enter all time schedules per Owner’s direction. Individual device time-delay settings are handled as part of the Room/Zone Checkout described in this Section.
6. Validate all interfaces with other systems on a point-by-point basis.

E. Training: Train Owner's maintenance personnel on the operation, programming and maintenance of the lighting controls.

3.17 INTEGRATED LIGHTING CONTROL SYSTEMS

A. Include all applicable ‘Start-Up Checks Common to All Systems”. Additional Start-Up Checks and Tests are as follows.

B. General: Provide the services of a factory-trained manufacturer’s representative to assist the Contractor in the installation and start-up service of the lighting control system and train Owner's maintenance personnel as specified below. Representative will confirm the proper installation and operation of all system components. Refer to the quality control requirements listed in applicable sections of Division 25 and 26 for additional checks and tests. These shall be included in the Start-Up Checks and Tests used for this project.

C. Start-Up Checks: During start-up, perform the following checks and any additional checks specified in manufacturer’s instructions.

1. Ensure all labeling is affixed and accurate.
2. Ensure all terminations are tight.

3. Check sensor placement is adequate for required duty.
4. Ensure adequate access is provided to all panels and that documentation of that panel is provided in it.
5. Ensure all circuits for the loads are energized and ready for testing.
6. Obtain all time schedules, individual device time-delay settings for all spaces, and on/off fade- rate settings from the Owner.

D. Start-Up Tests: During start-up, perform the following tests, measurements, or procedures and any additional tests, measurements, or procedures specified in manufacturer's instructions.

1. Test, calibrate, and set all digital and analog sensing, and actuating devices. Calibrate each instrumentation device by making a comparison between the graphic display and the reading at the device, using an instrument traceable to the National Bureau of Standards, which shall be at least twice as accurate as the device to be calibrated (e.g., if field device is +/-0.5% accurate, test equipment shall be +/-0.25% accurate over same range). Record the measured value and displayed value for each device in the Start-Up Report.
2. Check each digital control point by making a comparison between the control command at the control panel and the status of the controlled device. Check each digital input point by making a comparison of the state of the sensing device and the OI display. Record the results for each device in the BAS Start-Up Report.
3. Check full load current on all breakers serving controlled lighting to ensure that the breaker is properly sized.
4. Check full load current on all control device contacts serving controlled lighting to ensure that the contact rating is properly sized.
5. Enter all time schedules, override time-delays and on/off fade rates per Owner's direction.
6. For Operator Interfaces:

    a. Verify all elements on the graphics are functional and properly bound to physical devices and/or virtual points and that hot links or page jumps are functional and logical.
    b. Output all specified reports for review and approval.
    c. Verify the alarm printing and logging is functional and per requirements.

7. Validate all interfaces with other systems on a point-by-point basis.

E. Training: Train Owner's maintenance personnel on the operation and programming of the lighting control system. Two days of training will be provided.

3.18 UNINTERRUPTIBLE POWER SYSTEMS (UPS)

A. Include all applicable 'Start-Up Checks Common to All Systems". Additional Start-Up Checks and Tests are as follows.

B. General: Provide the services of a manufacturer-certified specialist to supervise the installation, make adjustments, and perform tests on the UPS and train Owner's maintenance personnel. Refer to the quality control requirements listed in applicable sections of Division 26 for additional checks and tests. These shall be included in the Start-Up Checks and Tests used for this project.

C. Start-Up Checks: During start-up, perform the following checks and any additional checks specified in manufacturer's instructions.

1. Inspect equipment for damage and foreign materials.
2. Check battery cells for proper electrolyte levels.

3. Check ventilation, room cleanliness, use of proper signs, and other required safety related items.
4. Check cell numbering.
5. Check cell interconnections with respect to polarity throughout battery.
6. Check cell tops for cleanliness.
7. Check power connections for tightness.
8. Check control wiring terminations and plugs for tightness and/or seating.
9. Check that sub-assemblies and components are secure.
10. Check torque on battery cell posts.
11. Check system for grounds.
12. Check DC bus for short circuits.
13. Check input and bypass power for proper voltages and phase rotation.
14. Check power supply voltages, and adjust if necessary.
15. Check lamp test functions.
16. Check control battery terminations.

D. Start-Up Tests: During start-up, perform the following tests, measurements, or procedures and any additional tests, measurements, or procedures specified in manufacturer's instructions.

1. Verify that alarms are in "Normal" condition.
2. Energize unit and verify DC, walkup, and AC input, and output power.
3. Check DC link voltage, AC output voltages, and output waveforms.
4. Check final DC link voltage and inverter AC output. Adjust if required.
5. Check for synchronization between UPS and Utility.
6. Check for voltage difference between inverter output and bypass source.
7. Check battery discharge.
8. Check DC under voltage warning.
9. Check DC overvoltage and DC under voltage trips.
10. Check AC overvoltage and AC under voltage trip.
11. Check for proper control battery float voltage.
12. Verify proper system protection settings including undervoltage and overvoltage transfer settings and Voltage difference.
13. Transfer Tests: With test load energized on Critical Bus, perform the following tests while monitoring Critical Bus with an oscilloscope. Verify no interruption in Critical Bus waveforms.

    a. Manually transfer load from 'Bypass' to 'UPS'.
    b. Manually transfer load from 'UPS' to 'Bypass'.
    c. Simulate a transfer fail to 'UPS'. Verify that "Transfer Fail" lamp annunciates and load remains on 'Bypass'.
    d. Simulate a transfer failure to 'Bypass'. Verify "Transfer Fail" lamp annunciates and load remains on 'UPS'.

E. Functional Performance Tests: Perform the following functional performance tests in accordance with Section 019100 and 019110:

1. Provide Load Bank with adequate rating to test the output of the UPS.
2. Steady State Load Tests: With test load at 1.0 and 0.8 power factor, perform the following tests:

    a. With all available load energized on Critical Bus, transfer load to system. Verify inverters' output currents are balanced within 10 percent.
    b. With UPS online, simulate a Utility failure by disconnecting Utility input to system. Verify no disturbance on output bus. Verify that battery supports load for 15 minutes. Record DC link voltages at 1 minute intervals. Verify that UPS output frequency is stable.

3. Energize the Utility input:

    a. Verify no disturbance on output bus.
    b. Verify ‘Sync to Utility’ command is issued only when inverters and Utility are in phase.
    c. Verify correct rectifier/charger walk-in.
    d. Record input currents of rectifier/chargers while in current limit mode.

4. Load Bank Test: Validate all HVAC systems in the UPS room are operational. Monitor temperature of room throughout load bank testing. Connect load bank while UPS is being fed by utility power and:

    a. Load the UPS at 25%, 50%, 75%, and 100% load. Part load durations shall be 30 minutes. Full load shall be 1 hour.
    b. Provide a load step of 100% and validate voltage and frequency stabilize appropriately.
    c. Perform a battery discharge test. Monitor, record and plot the THD, frequency, current, and voltage of the output throughout the test. Prepare and properly charge the batteries as recommended by manufacturer. Disconnect utility feed with full load on the system. Monitor voltage of all batteries throughout the test.

        1) During full load discharge test, provide infrared scan of all UPS and battery components.

    d. Where redundant UPS modules are connected, connect design load with all operating. Fail the design number of redundant modules by opening the battery disconnect and input power circuit breaker and validate proper output to system for 2 minutes after failure. Reconnect failed components and repeat until all modules have been failed.

5. The following series of tests shall be coordinated with the Building Black Out tests, simulate a building outage with UPS on line and all available load connected. Verify the following:

    a. Generator automatically starts and transfers online.
    b. Rectifier/chargers operate correctly while on Generator power.
    c. No output disturbance during transfer to Generator.

6. Re-energize Utility voltage and verify the following:

    a. Transfer switch returns to ‘Utility’ position.
    b. Inverter synchronizes to ‘Utility’.
    c. Correct rectifier/charger operation.
    d. No output bus disturbance during transfer back to ‘Utility’.

7. De-energize rectifier/chargers and battery disconnects, and then recheck torque on battery cell posts.
8. Endurance Test: Purpose is to demonstrate full capability and to ensure that system's functional performance is consistent with factory acceptance test and that installation conforms to system documentation. Minimally include the following:

    a. With Critical Load on system, measure and record input and output voltages and currents on each module, and system monitor and output cubicle.
    b. Verify that input, DC, and output waveforms are correct.
    c. Record system room ambient air temperature.
    d. Record battery room ambient air temperature.

e. Record module elapsed time meters.
f. Perform initial battery charge at 2.50 V per cell.
g. Prove system operation on battery power, plot rundown performance of system to limiting battery condition, demonstrate low voltage shutdown and emergency shutdown control operation, and execute restoration of AC power and subsequent battery recharge under full load conditions using dummy loads. Output power characteristics throughout testing shall be continuously recorded. Make available to A/E for review and for certification and documentation of meeting minimum system performance criteria.
h. Operate system, in accordance with design limits and in support of steady-state full load, simulated by load banks, for 48 contiguous hours without part or component failure. Record system performance for A/E review and records.

F. Training: Train Owner's maintenance personnel on procedures and schedules related to start-up and shutdown, troubleshooting, servicing, and preventative maintenance.

3.19 WORK SEQUENCE ILLUSTRATION

A. Reference Section 019100.

3.20 TRAINING

A. System training requirements are detailed in 019100.

END OF SECTION 260800

SECTION 26 01 00 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section

B. Section Includes: This section provides basic electrical requirements.

1.02 BASIC ELECTRICAL REQUIREMENTS

A. Quality Assurance:

1. Workers possessing the skills and experience obtained in performing work of similar scope and complexity shall perform the Work of this Division.

2. Refer to other sections of the Specifications for other qualification requirements.

B. Drawings and Specifications Coordination:

1. For purposes of clearness and legibility, Drawings are essentially diagrammatic and the size and location of equipment is indicated to scale whenever possible. Verify conditions, dimensions, indicated equipment sizes, and manufacturer's data and information as necessary to install the Work of this Division. Coordinate location and layout with other Work.

2. Drawings indicate required size and points of termination of conduits, number and size of conductors, and diagrammatic routing of conduit. Install conduits with minimum number of bends to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and comply with applicable code requirements.

3. Routing of conduits may be changed provided that the length of any conduit run is not increased more than 10 percent of length indicated on the Drawings.

4. Outlet locations shall be coordinated with architectural elements prior to start of construction. Locations indicated on the Drawings may be distorted for clarity.

5. Coordinate electrical Work with all other Work.

6. The scope of the electrical work includes furnishing, installing testing and warranty of all Electrical work and complete electrical systems shown on the electrical drawings and specified herein.

7. The drawings and specifications complement each other and together complete the contract documents for the electrical work included in this project. Neither the drawings nor the specifications are complete without the other. Any item mentioned in either document is binding. Where conflicts arise between the drawings and the specifications, the more stringent requirement shall prevail.

8. The contractor shall provide and install all electrical systems to provide a complete package as indicated by the contract documents. The documents are intended to provide an outline for the required installations. The contractor shall ultimately provide a complete and operational system at the conclusion of the project.

9. Details are provided as they relate to the installation. Contractor shall provide and install all miscellaneous components, parts, materials, fasteners, splices, and any other incidental items necessary to provide a complete installation.

C. Terminology:

1. Signal Systems: Applies to fire alarm, annunciator, sound, telephone, television, inter-communication, and network systems.

2. Low Voltage: Applies to signal systems operating at 120 volts and less, and power systems operating at less than 600 volts.

3. UL: Underwriter's Laboratories Inc, Nationally Recognized Testing Laboratory (NRTL), or equal.

D. Regulations: Work shall comply with the requirements of authorities having jurisdiction and the Electrical and Building Codes. Material shall conform to regulations of the National Board of Fire Underwriters for electrical wiring and apparatus. Materials shall be new and listed by UL, or another NRTL.

E. Structural Considerations for Conduit Routing:

1. Where conduits pass through or interfere with any structural member, or where notching, boring or cutting of the structure is necessary, or where special openings are required through walls, floors, footings, or other buildings elements, contractor shall submit shop drawings to the architect for approval.

2. Holes required for conduit entrances into speaker poles, floodlight poles or other poles, shall be drilled with the conduit nipple or coupling welded to poles. Welds shall be provided by the electric arc process and shall be continuous around nipple or coupling.

F. Electrically Operated Equipment and Appliances:

1. Furnished Equipment and Appliances:

a. Work shall include furnishing and installing wiring enclosures for, and the complete connection of electrically operated equipment and appliances and electrical control devices which are specified to be furnished and installed in this or other sections of the Specifications, wiring enclosures shall be concealed except where exposed Work is indicated on the Drawings.

b. Connections shall be provided as necessary to install equipment ready for use. Equipment shall be tested for proper operation and, if motorized, for proper rotation. If outlets are of incorrect electrical characteristics or any specified equipment fails to operate properly, repair and/or replace the outlet and/or equipment.

2. Equipment and Appliances Furnished by Others:

a. Equipment and appliances indicated on Drawings as "not in contract" (NIC), "furnished by others," or "furnished by the Owner," will be delivered to the Project site. Required electrical connections shall be performed for such equipment and appliances. Motorized equipment will be furnished factory-wired to a control panel or junction box unless otherwise indicated. Appliances will be furnished equipped with portable cord and cap. Provide disconnect switches where required.

b. Connections to equipment furnished under this Division shall be part of the Work of this section. Work shall include internal wiring, installation, connection and adjustment of bolted drive motors in which the motor is supplied as a separate unit, and connections only for equipment furnished with factory installed internal wiring, except as further limited by Drawings and this Specification. Work shall include furnishing and

installing suitable outlets, disconnecting devices, conduit, junction boxes, and wiring necessary for a complete electrical installation. Work shall also include furnishing and installing conduit and boxes for HVAC control systems, furnished under Division 15. Devices and equipment furnished shall be of same type used elsewhere on the Work or as specified.

c. Electrical equipment furnished under other sections, for installation and connection under Work of this section, will be delivered to the Project site ready for installation.

d. Equipment furnished under other sections, and requiring electrical connection under this section, will be set in place as part of the Work of the section furnishing such equipment unless noted otherwise. If electrical connections exceed the requirements of the specified equipment, it shall be the responsibility of the contractor or vendor supplying the equipment to compensate the electrical contractor for any and all work to make the electrical connections to the equipment being supplied. Any discrepancies shall immediately be brought to the engineers' attention for coordination between all other disciplines. All increased costs shall be the responsibility of the contractors, not the owner, architect, or engineer.

e. Suitability and condition of equipment furnished under other sections shall be determined in advance of installation. Immediate notice of damage, unsuitability, or lack of parts shall be given to the entity providing such equipment.

G. Protection of Materials:

1. Protect materials and equipment from damage and provide adequate and proper storage facilities during progress of the Work. Damaged materials and/or equipment shall be replaced.

H. Cleaning:

1. Exposed parts of Work shall be left in a neat, clean, usable condition. Finished painted surfaces shall be unblemished and metal surfaces shall be polished.

2. Thoroughly clean parts of apparatus and equipment. Exposed parts to be painted shall be thoroughly cleaned of cement, plaster, and other materials. Remove grease and oil spots with solvent. Such surfaces shall be wiped and corners and cracks scraped out. Exposed rough metal shall be smooth, free of sharp edges, carefully steel brushed to remove rust and other spots, and left in proper condition to receive finish painting.

3. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

I. Permits and Regulations:

1. Include payment of all permit and inspection fees applicable the work in this Division.

2. Work must conform to the National Electric Code, National Electrical Safety Code, and other applicable local, state, and federal laws, ordinances, and regulations. Where drawings or specifications exceed code requirements, the drawings and specifications shall govern. No work shall be installed which is less than minimum legal standards.

3. All work performed under this Division shall be inspected and approved by the Local Authority having Jurisdiction.

J. Site Inspection:

1. Each and all bidders shall inspect the project site prior to bidding.

2. Existing site conditions shall be compared with the information shown on the drawings. Immediately report any discrepancies to the Architect. After project bid date, no allowances will be made for failure to have made inspections.

3. During construction, the contractor shall exercise care and take appropriate precautionary measures to prevent any damage to the existing structures, sidewalks, utilities, communications, etc. during the project. The Contractor shall correct all damage caused by or during the project. Contractor shall provide not less than (2) and not more than (10) working days advance written, electronic, or telephonic notice of the commencement, extent, location and duration of the excavation work to Mississippi One-Call System, Inc. (1-800-227-6477) and any nonmembers operator(s) of any underground utility lines or underground facilities in and near the excavation area, so that Mississippi One-Call System, Inc operator(s) and any non-member operator(s) may locate and mark the location of underground utility lines and underground facilities in the excavation area.\

K. Utility Coordination:

1. Contractor shall inspect and verify the existing utilities at the project site prior to bidding.

L. Temporary Lighting and Power for Construction:

1. The electrical contractor shall provide and install temporary lighting during the period of construction. Temporary lighting shall be provided to meet all local ordinances, codes, and safety requirements. Lighting shall be installed in all open, general, and thoroughfare areas of construction. This shall not include any task lighting specifically required by any trade to complete their work or installations.

2. The electrical contractor shall provide and install temporary power during the construction period as required to complete the project installation. Contractor shall coordinate with the general contractor, and/or owner to provide 120/240 volt power for the project. All devices shall be provided with ground fault circuit protection. Power shall be provided in central work area(s). This shall not include any remote power needs for any specific trades. For power requirements at voltages other than those listed above, the contractor shall coordinate connection requirements with the local utility company.

3. All temporary lighting and power installations shall meet local and national codes and be approved by the local authority having jurisdiction.

4. Coordinate with college maintenance personnel for temporary power connection location.

1.03 SUBMITTALS

A. Where indicated submit to architect, (7) copies of Shop Drawings including control diagrams, list of materials, catalog cuts, technical data, manufacturer's specifications, and applicable installation details.

1.04 RECORD DRAWINGS

A. The Electrical Contractor shall maintain, at the project site, a separate set of prints of the contract documents and shall show all changes and variations, in a neat and clearly discernible manner, which are made during construction. Upon completion of the work, these drawings shall be turned over to the Architect. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: “2 sets of CDs and prints for Owner’s use, one set of CDs, prints for Architect / Engineers Records”. Delivery of these as-built electronic files and prints are a condition of final acceptance.

1.05 OPERATION AND MAINTENANCE MANUALS

A. The Electrical Contractor shall submit to architect (3) copies each of operating and maintenance manuals for each piece of equipment applicable to the project.

B. All shop drawings, installation, operation, and maintenance manuals, wiring diagrams, parts lists, and other information including warranties and technical support, shall be obtained from each manufacturer.

C. Assemble all information into three-ring binders or other suitable binding. Add an index and/or tabbed and labeled sections of all items submitted.

D. The Electrical Contractor shall at all times, maintain a clean set of construction document plans on site. Any and all deviations from the construction documents shall be marked, and clearly noted in red ink. All changes shall exactly indicate the revisions or changes to the design documents. Upon completion of the project, (2) clean sets of "red-line" construction as-built documents shall be submitted to the architect. Unclear, illegible, or inaccurate plans will be returned to the contractor for correction and resubmission. As-built documents shall be corrected by the Electrical Contractor and resubmitted at no additional cost.

1.06 INSPECTIONS AND PUNCH LIST

A. The Electrical Contractor shall survey and inspect his work and develop his own punch list to confirm that work is complete and finished. He shall then notify the General Contractor that work is complete and ready for inspection by the Architect. It is not the Architects or Engineers obligation to perform a final inspection until the contractor states his work has been inspected and is complete and ready for final inspection.

B. Request to the Architect, Engineer, or Owner for final inspection may be accompanied by a limited list of known deficiencies with a brief explanation or status of deficiencies and schedule for completion of each. Correction of these items shall be completed within (30) days of inspection or before final acceptance of occupancy.

1.07 WARRANTY

A. The Electrical Contractor shall warrant all workmanship, equipment, and materials installed under this contract for a period of (1) year minimum from the date of final acceptance as agreed between the Contractor and the Architect, unless indicated by other sections of these specifications.

B. Any equipment, materials, etc. proving to be defective during the warranty period shall be corrected or replaced without any expense to the Owner or other parties. This provision shall not be construed to include general maintenance items or luminaire lamps or correcting errors on the part of the owner, owner's personnel, or owner's representative.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and Equipment furnished under this contract shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more items of equal and similar materials and construction are required, they shall be of the same manufacturer.

B. All electrical equipment and materials shall bear the Underwriters Laboratories, Inc. label, and shall comply with the NEC and NFPA requirements as applicable.

2.02 MATERIALS AND EQUIPMENT SELECTION

A. Selection of Materials and Equipment furnished under this contract shall be determined by the following:

1. Where trade names, brands, and manufacturer's part numbers are listed, the exact equipment listed shall be furnished. Where more than one name is used, the contractor shall have the option of selecting between those specified. All products used shall be equal to that specified and shall be of best quality.

2. When the words "or equal" appear, specific approval must be obtained from the Architect during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.

3. Alternate materials and/or equipment must be submitted for approval a minimum 2 weeks prior to project bid date.

B. Before bidding, when preparing shop drawings, and prior to rough-in for installation, the contractor shall verify that adequate space is available for entry and installation of the item including any accessories. Also that adequate space is available for servicing equipment and required code clearances are satisfied.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Advise the general contractor or architect before starting the Work of this Division.

B. Exposed conduits shall be painted to match the surfaces adjacent to installation. Refer to painting and coating section of specifications.

C. Salvaged materials, if applicable, removed from buildings shall be removed from the Project site as required by the general contractor.

D. Trenches outside of barricade limits shall be backfilled and paved within 24 hours after being inspected. Provide traffic plates during the time that trenches are open in traffic areas and in areas accessible to nonconstruction personnel.

E. Where structural walls are cored for new conduit runs, separation between cored holes shall be 3 inches edge to edge, unless otherwise required by the Architect. All coring to be laid out and reviewed by Architect prior to drilling. Contractor to verify location of structural steel, rebar, stress cabling, or similar prior to lay out.

F. Electrical equipment shall be braced and anchored as indicated on the Drawings.

3.02 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 26 01 11 - WORK IN EXISTING FACILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section

B. Section Includes: This section provides electrical requirements for demolition or rework of existing systems. Work shall include all existing electrical including auxiliary systems. Coordinate with owner and General Contractor for removal and rework of all electrical systems.

1.02 DEMOLITION OF EXISTING ELECTRICAL SYSTEMS

A. In reworked and renovated areas, remove all electrical equipment including but not limited to: Light fixtures, panelboards, switches, receptacles, auxiliary system devices, telephone outlets, life safety devices, and fire alarm; unless otherwise noted. Where noted or required, remove existing branch circuits, conduits, wiring, junction boxes, hangers, fittings, etc. serving equipment to be removed and as noted on drawings. Abandon conduits concealed in concrete, but remove conductors. Leave existing branch circuits and feeders which run through reworked areas and serve existing equipment to remain in service, continuous and uninterrupted. Repair, reterminate, re-support, etc., any damaged circuits.

B. Abandon junction boxes where devices are located in block walls. Remove any plates or extension rings. Fill box with grout and finish over to match adjacent wall. Remove any wiring and cut off flush any conduits protruding from wall.

C. Where below grade conduits are abandoned, cut off 2-3" below slab, grout over and finish smooth to match adjacent flooring, or finish ready to accept floor covering.

1.03 CUTTING, PATCHING, AND REPAIRING

A. Electrical contractor shall coordinate with General Contractor for all cutting, patching, and repairing. Electrical contractor shall perform all cutting or allow general contractor to perform cutting in a professional manner. Flooring and walls shall be cut in straight lines and parallel or perpendicular to walls. Electrical contractor shall coordinate and notify General Contractor of all cutting prior to bid and shall be responsible for any costs associated with cutting, patching, and repairing.

B. Do not pierce or cut any existing walls below grade.

C. Do not cut any structural walls or structural members, unless receiving approval in writing from the architect and structural engineer.

D. All new work shall match and be comparable to existing conditions or new adjacent finishes. Architect and engineer reserve the right to reject any unsuitable work.

1.04 ELECTRICAL SYSTEMS

A. Electrical, low voltage, systems wiring, life safety, etc. in areas outside of work area shall remain in service at all times. Provide and install necessary temporary wiring as required to maintain continuity of all electrical systems outside of the work area.

B. Where service interruptions are required, obtain approval for interruption in writing from Owner 10 days prior to interruption. Include schedule of work to be performed

and the time required to accomplish work in request for interruption. Work during service interruptions may be required after normal working hours. Include premium (overtime) time labor in bid. No service interruptions shall occur until written approval is granted from the owner.

1.05 MATERIAL TO BE REMOVED/SALVAGED

A. Where noted, salvaged materials are to be reused. Clean any reused materials prior to reinstalling and at the completion of the project.

B. When materials are demolished and shown to be removed, the owner has the right to retain any desired/salvageable materials.

C. Discard or remove from site any materials not retained by the owner.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Advise the general contractor or architect before starting the Work of this Division.

B. Demolished or Salvaged materials, if applicable, removed from buildings shall be removed from the Project site as required by the general contractor.

3.02 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section

B. Section Includes: Low-voltage wire, splices, terminations and installation.

1.02 SUBMITTALS

A. None.

PART 2 - PRODUCTS

2.01 WIRES

A. Wires shall be single conductor type THHN or THWN insulated with polyvinyl chloride and covered with a protective sheath of nylon, rated at 600 volts. Wires may be operated at 90 degrees C. maximum continuous conductor temperature in dry locations, and 75 degrees C. in wet locations and shall be listed by UL Standard 83 for thermoplastic insulated wires, listed by Underwriter's Laboratories (UL) for installation in accordance with Article 310 of the National Electrical Code (NEC). Conductors shall be solid or stranded copper for 12 AWG and smaller conductors, and stranded copper for 10 AWG and larger conductors. Conductors shall be insulated with PVC and sheathed with nylon. Wires shall be identified by surface markings indicating manufacturer's identification, conductor size and metal, voltage rating, UL symbol, type designations and optional rating. Indentations for lettering is not permitted. Wires shall be tested in accordance with the requirements of UL standard for types THWN, or THHN.

B. Conductors shall be solid Class B or stranded Class C, annealed uncoated copper in accordance with UL standards, or another Nationally Recognized Testing Laboratory (NRTL).

2.02 STANDARDS

A. THWN/THHN wires shall comply with the following standards:

1. UL 83 for thermoplastic insulated wires.
2. UL 1063 for machine tool wires and cables.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Wires shall not be installed until debris and moisture is removed from conduits, boxes, and cabinets. Wires stored at site shall be protected from physical damage until they are installed and walls are completed.

B. Wire-pulling compounds furnished as lubricants for installation of conductors in raceways shall be compounds approved and listed by UL, NRTL, or equal. Oil, grease, graphite, or similar substances are not permitted. Pulling of 2 AWG or larger conductors shall be performed with a cable pull machine. Any runs shorter than 50 feet are exempt. When pulling conductors, do not exceed manufacturer’s recommended values

C. At outlets for light, power, and equipment, pigtail splices with 8-inch circuit conductor leads for connection to fixtures, equipment, and devices.

D. Pressure cable connectors, pre-insulated Scotchlok, 3M, or equal, Y, R or B spring-loaded twist-on type, may be furnished in splicing number 8 AWG or smaller wires for wiring systems; except public address and telephone systems.

E. All Joints, splices, taps, and connections to panelboard neutral, bonding or grounding conductors, conductors to ground busses, and transformer connections for wires 6 gauge and larger shall be performed with high-pressure cable connectors approved for installation with copper conductors. Connectors shall be insulated with heavy wall heat shrink WCSM, or cold-applied roll-on sleeve RVS. Insulation level shall be a minimum of 600V and joints, splices, and taps shall be qualified to ANSI C 119.2, UL, NRTL, or equal listed mechanical pressure connections.

F. Connections to any bussing and high-press cable connectors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade 5 machine screws secured with constant pressure-type locking devices.

G. Connection of any bonding or grounding conductors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade 5 machine screws secured with constant pressure-type locking devices.

H. Wiring in panelboards, panel cabinets, pull boxes, and other cabinets, shall be neatly grouped and tied in bundles with nylon ties at 10-inch intervals. In panelboards, panels and terminal blocks, wires shall be fanned out to terminals. If bundles are longer than 24 inches, a maximum of 9 current carrying conductors may be bundled together.

I. Install conductor lengths with a minimum length within the wiring space. Conductors must be long enough to reach the terminal location in a manner that avoids strain on the connecting lug.

J. Maintain the conductor required bending radius.

K. Neutral conductors larger than 6 gauge, which are not color identified throughout their entire length, shall be taped, painted white or natural gray, or taped white where they appear in panelboards, cabinet, gutters or pull boxes. Neutral conductors 6 gauge and smaller shall be white color identified throughout their entire length.

L. Fire alarm wiring shall be continuous from terminal cabinets or from equipment to each device. Splices are not permitted between devices and/or terminal cabinets at junction and pull boxes. Wiring shall be terminated at terminal blocks or devices only.

M. Wiring systems shall be free from short circuits and grounds, other than required grounds.

3.02 COLOR CODES

A. General Wiring:

1. Color code conductor insulation as follows:

SYSTEM VOLTAGE	
Conductor	208Y/120
Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White

Neutrals shall be colored-distinguished if circuits of two voltage systems are used in the same raceway.

2. For phase and neutral conductors 6 gauge or larger, permanent plastic-colored tape may be furnished to mark conductor end instead of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.

3.03 FEEDER IDENTIFICATION

A. Feeder wires and cables shall be identified at each point the conduit run is broken by a cabinet, box, gutter, etc. Where terminal ends are available, identification shall be by means of heat shrink wire markers, which provide terminal strain relief. Markers shall be Brady Perma-Sleeve, or equal. Identification in other areas shall be by means of wrap-around tape markers Brady Perma-Code or equal. Markers shall include feeder designation, size, and description.

3.04 TAPE AND SPLICE KITS

A. Splices, joints, and connectors joining conductors in dry and wet locations shall be covered with insulation equivalent to that provided on conductors. Free ends of conductors connected to energized sources shall be taped. Voids in irregular connectors shall be filled with insulating compound before taping. Thermoplastic insulating tape approved by UL, NRTL, or equal for installation as sole insulation of splices shall be furnished and shall be installed according to manufacturer's printed specifications.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.06 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section

B. Section Includes: Provide and install grounding system as indicated or required.

C. Related Sections:

1. Refer to related sections for their system grounding requirements.
2. Section 26 01 00: Basic Electrical Requirements.
3. Low Voltage Systems

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. IEEE 142 Green Book.
2. Underwriter's Laboratories (UL).
3. National Electrical Code.
4. Building Industry Consultant Services International (BICSI) (Signal).
5. EIA/TIA (Signal and power).
6. Nationally Recognized Testing Laboratory (NRTL) or equal.

1.03 SYSTEM DESCRIPTION

A. Metallic objects on the Project site that enclose electrical conductors, or that are likely to be energized by electrical currents, shall be effectively grounded.

B. Metal equipment parts, such as enclosures, raceways, and equipment grounding conductors, and earth grounding electrodes shall be solidly joined together into a continuous electrically conductive system.

C. Metallic systems shall be effectively bonded to the main grounding electrode system.

D. A separately derived AC source shall be grounded to the equipment grounding conductor, and to separate “made” electrode of building grounding electrode system.

E. Electrical continuity to ground metal raceways and enclosures, isolated from equipment ground by installation of non-metallic conduit or fittings, shall be provided by a green insulated grounding conductor of required size within each raceway connected to isolated metallic raceways, or enclosures at each end. Each flexible conduit over 6 feet in length shall be provided with a green insulated grounding conductor of required size.

F. Cold water, or other utility piping systems, shall not be utilized as grounding electrodes due to the installation of insulating couplings and non-metallic pipe in such installations.

G. Neutral of service conductors shall be grounded as follows:

1. Neutral shall be grounded at only one point within the Project site for that particular service. Preferable location of grounding point shall be at the service panelboard, or main switch.

2. Equipment and conduit grounding conductors shall be bonded to that grounding point.

3. Feeder neutrals shall be bonded at service entrance point only, neutrals of separately derived systems shall be bonded at the source only.

H. Within every building, the main panelboard, shall be bonded to the cold water line. Metallic piping systems such as gas, fire sprinkler, or other systems shall be bonded to the cold water line.

1.04 SUBMITTALS

A. None.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Electrodes (where noted) shall be copper-clad steel ground rods, minimum 3/4 inch diameter by 10 feet long.

B. Grounding conductors shall be copper, #12 minimum with green insulation, unless noted otherwise.

C. Ground tails shall be copper, #12 minimum with green insulation, installed in all metallic junction boxes where devices are being installed. Branch circuit ground, junction box, and devices shall be bonded at each junction box.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All grounding shall be installed in accordance with details on drawings and per NEC 250.

B. Bond panelboards and all electrical boxes and enclosures.

C. All conduits shall have a grounding conductor, minimum #12 copper. Conductor size shall be increased based on ampacity and/or phase conductors of the circuit.

D. Install grounding conductors at each panelboard location as noted on drawings.

E. All branch circuit, device, and switch junction boxes shall contain a grounding conductor, minimum #12 copper with green insulation, to bond the one or more equipment grounding conductors and the metal box. Connections shall be made to splice the equipment grounding conductors, grounding pig-tail, and metal box by means of a grounding screw or listed grounding device.

3.02 TESTING

A. Test grounding resistance of electrodes, ground rods, bonding of building steel, water pipes, gas pipes and other utility piping. Tests shall be performed as follows:

1. Visually and mechanically examine ground system connections for completeness and adequacy.

2. Ground testing reports shall be submitted to Construction Administrator for review.

3. Ground testing reports shall be included in Construction Documents Manual.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.04 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section

B. Section Includes:

1. Raceways and wire ways
2. Conduit installation.
3. Underground requirements.
4. Boxes, enclosures, keys and locks.
5. Identifications and signs.

C. Related Sections:

1. Section 26 01 00: Basic Electrical Requirements.

D. Applicable Standards and Codes

1. EIA/TIA 569 Standards.
2. National American Standards Institute (ANSI)
3. National Electrical Manufacturer's Association (NEMA)
4. Nationally Recognized Testing Laboratory (NRTL)
5. National Electrical Code (NEC)
6. Underwriters Laboratory (UL)

1.02 SUBMITTALS

A. None.

PART 2 - PRODUCTS

2.01 RACEWAYS

A. Conduit Materials:

1. Metallic conduit, and tubing shall be manufactured under the supervision of an UL, or another NRTL factory inspection and label service program. Each 10-foot length of conduit and tubing shall bear the UL or another NRTL label and manufacturer's name.
2. Rigid metallic conduit shall be rigid steel, heavy wall, mild steel, zinc-coated, with an inside and outside protective coating manufactured in accordance with ANSI C 80.1. Couplings, elbows, bends, condulets, bushings and other fittings shall be the same materials and finish as the rigid metallic conduit. Fittings, connectors, and couplings shall be threaded type, manufactured in accordance with ANSI C 80.1 and UL 6.
3. Electrical metallic tubing shall be steel tubing, zinc-coated with a protective enamel coating inside, manufactured in accordance with NEMA C 80.3. Fittings, couplings, and connectors less than 2" shall be steel, gland compression type. Fittings, couplings, and connectors 2" and larger shall be

steel, set screw type or gland compression type. All parts shall be manufactured in accordance with NEMA C80.3 and UL 6A Electrical metallic tubing is designated hereinafter as EMT. Steel and rain tight fittings shall be approved and listed for the intended application.

4. Flexible metallic conduit shall be of flexible interlocking strip construction with continuous zinc coating on strips, manufactured in accordance with UL 1.

   a. Connectors and couplings shall be required fittings of the type, which threads into convolutions of flexible conduit.

   b. Non-metallic conduit is not allowed.

5. Liquid-tight flexible metal conduit shall be galvanized heavy wall, flexible locked metallic strip construction, UV rated, with smooth moisture and oil-proof, abrasion-resistant, extruded plastic jacket. Connectors shall be as required for installation with liquid-tight flexible conduit and shall be installed to provide a liquid-tight connection.

6. Non-metallic conduit shall be rigid PVC electrical conduit extruded to schedule 40 dimensions of Type II. Grade 1 high impact, polyvinyl chloride, sweeps, couplings, reducers and terminating fittings shall be listed under the UL, or another NRTL, and shall bear the manufacturer's listed marking.

7. Conduit size shall be 1/2" minimum for above grade installations and 3/4" minimum for below grade or in-slab installations.

8. Metal Clad (MC) cable system is not allowed. Except for fixture whip connections (6’ maximum length).

B. Sleeves for Conduits: Sleeves shall be adjustable type, of 26 gage galvanized iron, Adjust-to Crete Co. Adjust-to-Crete, or Jet Line Products Inc. Jet-Line, or equal.

C. Where conduit enters a building through a concrete foundation below grade, or ground water level, or where it is necessary to seal around a conduit where it passes through a concrete floor or wall, provide O-Z/Gedney Type FSK Thru Wall and Floor Seal, or equal.

D. Wireways shall be 16 gage galvanized steel enclosed hinge/screw wiring troughs, surface metal raceway, wireway, and auxiliary gutter designed to enclose electrical wiring. Wireway fittings shall be furnished with removable covers and sides to permit complete installation of conductors throughout the entire wireway run. Cover shall be furnished with keyhole slots to accept captive screws locking the cover securely closed. Wireways shall be UL or another NRTL listed, and shall be Square D Type LDG NEMA-1 enclosure for interior applications, or Type RD NEMA-3R enclosure for exterior applications, or equal by Cooper B-line, Hoffman, Wire Guard, or Circle AW.

E. Penetration in Fire-Rated Structures: Provide 3M, or equal, caulk and fire barriers for installing fire-rated seals around penetrations through floors, walls, and elevator shafts. Fire stop system must be UL, or another NRTL listed, and classified for through-penetration applications of metallic conduits and busways.

F. Pull Wires: Install 1/8 inch polypropylene cords in empty or spare conduits.

G. Surface Steel Raceway:

1. The surface steel raceway system for branch circuit wiring, data network, voice, video, and other low voltage wiring shall be as manufactured by the Wiremold Company, Hubbell, or Panduit or equal.

2. The raceway base, cover, and device bracket shall be manufactured of steel and finished in ivory, gray enamel or custom colors suitable for field painting to match adjacent finishes.

3. The raceway shall be a 2-piece design with a metal base and snap-on metal cover, except for the Wiremold V700 system or Hubbell V750 series. The base and cover sections shall be a minimum of 0.040 inch wall thickness. The base section shall be available in 10-foot lengths. A hand-operated cutting tool shall be available for the base and cover to ensure clean, square cuts. Wiremold V500 and Hubbell V500 or similar series are not permitted.

4. A full complement of fittings shall be furnished, including but not limited to, flat internal and external elbows, tees, entrance fittings, wire clips, cover clips, couplings, support clips, C-hangers and end caps. The fitting color shall match the raceway color. Fittings shall be supplied with a base where indicated and/or required. A take-off fitting shall be furnished as required to adapt to existing flush wall boxes.

5. Device brackets shall be furnished for mounting single or 2-gang devices within the raceway. Devices shall be provided with the ability of mounting flush or in conjunction with standard steel, stainless steel, or manufacturer's metal faceplates.

6. The raceway shall be furnished with a complete line of connectivity outlets and modular inserts for unshielded twisted pair including category 5, fiber-optic, coaxial, and other cabling types with face plates and bezels to facilitate installation. Computer data installation shall be as required by other sections of this Specification.

7. Raceway shall be furnished with corner elbows and tee fittings to maintain a cable bend radius which meets the requirements of fiber-optic and copper cables under EIA/TIA 569 for communications pathways.

2.02 BOXES, ENCLOSURES, KEYS AND LOCKS

A. Outlet Boxes and Fittings:

1. Outlet boxes installed in concealed Work shall be galvanized steel, pressed, or welded type, with knockouts.

2. In exposed Work, where conduit runs change direction or size, outlet boxes and conduit fittings shall be cast metal with threaded hubs cast integral with box or fitting.

3. Fittings shall be cast metal and non-corrosive. Ferrous metal fittings shall be cadmium-plated or zinc galvanized. Castings shall be true to pattern, smooth, straight, with even edges and corners, of uniform thickness of metal, and shall be free of defects.

4. Covers for fittings shall be galvanized steel or non-corrosive aluminum and shall be designed for particular fitting installed.

5. Light fixture outlets shall be 4-inch octagon, 4-inch square, 2-1/8 inches deep or larger, depending upon number of conductors or conduits therein. Plaster or tile rings shall be furnished for suitable mounting of light fixture.

6. For local device outlets provide 4-inch square 2-1/8 inch deep, boxes for single gang, 4-11/16 inch square boxes for two-gang, and special solid gang boxes with gang plaster ring for more than 2 switches.

7. For fire alarm devices and horns and strobes provide manufacturers supplied back box as needed. For television outlets, provide 4-inch square 2-1/8 inch deep boxes with plaster or tile rings suitable for television device outlet(s).

8. Plaster or tile rings shall be provided on flush-mounted outlet boxes except where otherwise indicated or specified. Plaster or tile rings shall be same depth as finished surface. Install approved ring extension to obtain depth to finish surface.

9. In plywood wall or drywall construction, and where flexible steel conduit is fished into walls, one-gang and 2-gang outlets for wiring devices may be sectional steel boxes with plaster ears. Boxes shall be fastened to plywood with flat-head screws in each plaster ear screw hole.

10. Factory made knockout seals shall be installed to seal box knockouts, which are not intact.

11. Where flexible conduit is extended from flush outlet boxes, provide and install weatherproof universal box extension adapters.

B. Junction and Pull boxes:

1. Junction and pull boxes, in addition to those indicated, shall only be used in compliance with codes, recognized standards, and Contract Documents.

2. Interior and non-weatherproof boxes shall be constructed of blue or galvanized steel with ample laps, spot welded, and shall be rigid under torsion and deflecting forces. Boxes shall be furnished with auxiliary angle iron framing where necessary to ensure rigidity.

3. Covers shall be fastened to box with a sufficient number of brass machine screws to ensure continuous contact all around. Flush type boxes shall be drilled and tapped for cover screws if boxes are not installed plumb. Surfaces of pull and junction boxes and covers shall be labeled in black marker ink designating system, panelboard and circuit designation contained in box. In exposed Work, designation shall be installed on inside of pull box or junction box cover.

4. Weatherproof NEMA 3R pull and junction boxes shall conform to foregoing for interior boxes with following modifications:

   a. Cover of flush mounting boxes shall be furnished with a weather-tight gasket cemented to, and trimmed even with, cover all around.

   b. Surface or semi-flush mounting pull and junction boxes shall be UL, or another Nationally Recognized Testing Laboratory (NRTL) listed as rain-tight and shall be furnished complete with threaded conduit hubs.

   c. Exposed portions of boxes shall be galvanized and finished with one prime coat and one coat of baked-on gray enamel, unless already furnished with factory baked-on finish.

5. Junction and pull boxes shall be rigidly fastened to structure and shall not depend on conduits for support.

6. Underground utility boxes shall be reinforced concrete with non-setting shoulders to prevent settlement following installation. Boxes shall be furnished with cast iron cover with finger hole, size as indicated on Drawings.

7. Polymer Concrete Boxes:

a. Polymer concrete boxes are to be made from aggregates in combination with polymer resin, combined and processed by mixing, molding, and curing, and reinforced with fiberglass.

b. Boxes are to be high strength, impact resistant, corrosion resistant, nonflammable, and noncorrosive.

c. Enclosures, boxes and covers are required to conform to all test provisions of the most current ANSI/SCTE 77 “Specification For Underground Enclosure Integrity”

d. All components in an assembly (box & cover) are manufactured using matched surface tooling.

e. Covers shall be marked as electrical, power, communications, fiber, signal, etc. as required.

C. Keys and Locks:

1. Provide 2 keys with furnished door locks, including cabinet door locks and switchboard locks, 2 keys for lock switches on switchboards or control panels, and 2 keys with interlocks or other furnished lock switches.

2.03 IDENTIFICATION AND SIGNS

A. Identification Plates:

1. Provide identification plates for the following unless otherwise specified, for motor switches, panelboards, and terminal cabinets.

2. Identification plates shall be of plastic stock and shall adequately describe function, voltage and phase of identified equipment. Where identification plates are detailed or described on Drawings, inscription and size of letters shall be as indicated. For lighting and power panels, identification plates shall indicate panel designation, voltage, and phase of panel. For terminal cabinets, identification plates shall indicate system contained in terminal cabinet.

3. Identification plates shall be black-and-white nameplate stock of bakelite with characters cut through black exposing white. Plates shall be furnished with beveled edges and shall be securely fastened in place with No. 4 Phillips-head, cadmium-plated steel, self-tapping screws. Characters shall be 3/16 inch high, unless otherwise indicated.

B. Markings:

1. Install identification markings to surface-mounted starters, switches, disconnect switches, contactors, and other devices controlling motors and appliances. Provide abbreviations required along with an identifying number. Markings to be provided with locking type stencils using paint of a contrasting color. Figures shall be 3/8 inch high unless otherwise indicated. Self-sticking plastic labels, with embossed characters made with a typewriter may be installed instead of stencils and paint; self adhesive plastic, or self sticking laminated plastic labels may be installed.

PART 3 - EXECUTION

3.01 CONDUIT INSTALLATION

A. General Requirements:

1. Provide complete and continuous systems of rigid metallic conduit, outlet boxes, junction boxes, fittings and cabinets for systems of electrical wiring including lighting, power, and systems, except as otherwise specified.

2. EMT may be installed in interior concealed or exposed applications where not subject to damage. EMT shall not be installed in concrete, directly buried underground, outdoors, in boiler rooms, pits, or where subject to damage.

3. Within buildings, flexible metallic conduit may be installed instead of rigid steel conduit where permitted by code. Flexible metallic conduit shall not be installed for conduit installations longer than 6 feet (inclusive of fittings and boxes), in concealed ceilings or walls, and where conduit size is 1-1/2 inches or greater.

4. Flexible metallic conduit shall be installed for final connection of motor terminal boxes, shop equipment, mechanical equipment, HVAC equipment and other equipment, or for frequent interchange, and shall be of sufficient length, not exceeding 36 inches, to permit full travel or adjustment of motor on its base. Flexible metallic conduit shall not be used for equipment not requiring adjustment or frequent interchange.

5. Liquid-tight flexible metallic conduit shall be installed at exterior locations or where subject to liquid or oil exposure, except where otherwise specified, for final connection of equipment and as listed above.

6. Connectors for flexible metal conduit and liquid-tight flexible metallic conduit shall be compatible with the conduit, and of the types which threads into convolutions of conduit. Connectors for watertight flexible metal conduit shall be as required for installation and shall be installed to provide a watertight connection.

7. Exposed conduit shall be installed vertically and horizontally following the general configuration of the equipment, using cast threaded hub conduit fittings where required and shall be clamped to equipment with suitable iron brackets and one hole pipe strap.

8. If connection is from a flush wall-mounted junction box, install an approved extension box.

9. Underground feeder distribution conduits for systems may be non-metallic conduit instead of rigid conduit except where otherwise specified or indicated.

10. Conduit shall be concealed unless otherwise indicated. Conduits exposed to view, except those in attic spaces and under buildings, shall be installed parallel or at right angles to structural members, walls, or lines of building. Conduits shall be installed to clear access openings.

11. Bends or offsets will not be permitted unless absolutely necessary. Radius of each conduit bend or offset shall be as required by ordinance. Bends and offsets shall be performed with standard industry tools and equipment or may be factory fabricated bends or elbows complying with requirements for radius of bend specified. Heating of metallic conduit to facilitate bending is not permitted. Public telephone conduit bends and offsets shall be provided with a

radius which is not less than 10 times trade size of conduit unless otherwise permitted. Refer to underground installation, specified in this section, for radius of bends and offsets required for underground installations.

12. Running threads are not permitted. Provide conduit unions where union joints are necessary. Conduit shall be maintained at least 6 inches from covering of hot water and steam pipes and 18 inches from flues and breechings. Open ends of conduits shall be sealed with permitted conduit seals during construction of buildings and during installation of underground systems.

13. Expansion Joints/Seismic Separations/Separations between buildings/Locations Indicated: Provide Thomas & Betts XJG-TB, O-Z Electrical Mfg. Co. Inc. Type AX with bonding strap and clamps. At exterior locations, provide Thomas & Betts XJG-TB, O-Z Electrical Mfg. Co. Inc. Type EX, or equal. Provide O-Z Electrical Mfg. Co. Type AXDX, or equal Combination Deflection/Expansion Fittings at all seismic separations. Provide manufactures internal and external Bonding Jumpers at all locations. Liquid-tight flexible conduit shall not be approved at expansion joints or seismic separations.

14. Where conduits are terminated in groups at panelboards, cabinets, etc., provide templates or spacers to fasten conduits in proper position and to preserve alignment.

15. Where auxiliary supports, saddles, brackets, etc., are required to meet special conditions, they shall be fastened rigid and secure before conduit is attached.

16. Conduit in ceiling spaces, stud walls, and under floors, shall be supported with factory fabricated pipe straps or shall be suspended with pipe hangers or pipe racks. Pipe straps shall be attached to and shall fasten conduit tight at point of support against ceiling and floor joists, rafters, and wall studs, or 2-inch x 4-inch headers fitted between joists or wall studs.

17. Conduits installed on exposed steel trusses and rafters shall be fastened with factory fabricated conduit straps or clamps, which shall fasten conduit tight against supporting member at point of support.

18. Pipe hangers for individual conduits shall be factory fabricated. Steel rods shall be 3/8 inch for 2-inch conduit hangers and smaller and shall be 1/2 inch for 2-1/2 inch conduit hangers and larger.

19. Pipe racks for groups of parallel conduits and for supporting total weights not exceeding 500 pounds shall be trapeze type and shall consist of a cross channel, Steel City Kindorf B-900, Unistrut P-1000, or equal, suspended with a 3/8 inch minimum diameter steel rod at each end. Rods shall be fastened with nuts, top and bottom to cross-channel and with square washers on top of channel. Conduits shall be clamped to top for cross-channel with conduit clamps, Steel City Kindorf C-105 or Unistrut P-1111 through P-1124. Conduits shall not be stacked one on top of another, but a maximum of 2 tiers may be on same rack providing an additional cross-channel is installed. Where a pipe rack is to be longer than 24 inches, or if the supported weight exceeds 500 pounds, submit Shop Drawings of installation to the Architect for review.

20. Conduits suspended on rods more than 2 feet long shall be rigidly braced to prevent horizontal motion or swaying.

21. Factory fabricated pipe straps shall be one or 2-hole formed galvanized clamps, heavy-duty type, except where otherwise specified.

22. Conduits shall be supported at intervals required by code, but not to exceed 10 feet. One inch and smaller exposed conduits shall be fastened with one-hole

malleable iron straps. Perforated straps and plumber's tape is not permitted for the support of conduits.

23. Conduits stubbed up through a roof or facade shall be flashed with a waterproof flashing. Refer to roofing specification for additional requirements.

24. Bushings and locknuts for rigid steel conduit shall be steel threaded insulating type. Setscrew bushings are not permitted.

25. Flex conduits shall be cut square and not at an angle.

26. Routing of conduits may be changed providing length of any conduit run is not increased more than 10 percent of the length indicated on Drawings.

C. General Installation Requirements for Computer Network System Conduits:

1. Location of outlet boxes and equipment on Drawings is approximate, unless dimensions are indicated. Drawings shall not be scaled to determine position and routing of wireways, drops, and outlet boxes. Location of outlet boxes and equipment shall conform to architectural features of the building and other Work already in place and must be ascertained in the field before start of Work.

2. The maximum pulling tensions of the specified cables shall not be exceeded and proper radius of cable bends shall be maintained.

3. For computer network wiring, conduit types shall be limited to rigid metal conduit, electrical metallic tubing, schedule 40 PVC, multi-cell raceways, and flexible metallic conduit for lengths less than 6 feet.

4. Interior section of conduit run shall be not longer than 100 feet and shall not contain more than 2 bends of 90 degrees between pull points or pull boxes.

5. The inside radius of a conduit bend shall be at least 6 times the internal diameter of the conduit. When the conduit size is greater than 2 inches, the inside radius shall be at least 10 times the internal diameter of the conduit. For fiber-optic cable, the inside radius of a conduit bend shall be at least 10 times the internal diameter of the conduit.

6. Conduit shall be sized in accordance with Table 4.4-1 of EIA/ TIA 569 standard.

7. Splicing or terminating cables in pull boxes is not permitted.

8. For indoor application, a pull box shall be provided in conduit run where:

   a. The length is over 100 feet.

   b. There are more than 2 bends of 90 degrees.

   c. There is a reverse bend in the run.

9. Boxes shall be provided in a straight section of conduit and shall not be installed in lieu of a bend. The corresponding conduit ends are to be aligned with each other. Conduit fittings shall not be installed in place of pull boxes.

10. Where a pull box is provided with raceways, pull box shall comply with the following:

    a. For straight pull-through, provide a length of at least 8 times the trade-size diameter of the largest raceway.

    b. For angle and U-pulls:

       1) Provide a distance between each raceway entry inside the box and the opposite wall of the box of at least 6 times the trade-size diameter of the largest raceway, this distance being increased

by the sum of the trade-size diameters of the other raceways on the same wall of the box.

2) Provide a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:

a) Six times the trade-size diameter of the raceway; or

b) Six times the trade-size diameter of the larger raceway if they are of different size.

c) For a raceway entering the wall of a pull box opposite to a removable cover, provide a distance from the wall to the cover of not less than the trade-size diameter of the largest raceway plus 6 times the diameter of the largest conductor.

11. Drawings generally indicate Work to be installed, but do not indicate all bends, transitions of special fittings required to clear beams, girders or other Work already in place. Investigate conditions where conduits and wireways are to be installed, and furnish and install required fittings.

D. Concrete Walls, Beams, and Floors: Provide sleeves where conduits pierce concrete walls, beams, and floors, except floor slabs on grade. Sleeves shall provide 1/2 inch clearance around conduits. Sleeves shall not extend beyond exposed surfaces of concrete and shall be securely fastened to forms. Provide fire caulk materials as required. Where conduits pass through walls below grade, caulk with required sealant and backer materials between conduit and sleeve to provide a watertight joint.

3.02 INSTALLATION AND SUPPORT OF BOXES

A. Install outlet boxes flush with finished surface of wall or ceiling. Install plumb and securely fastened to structure, independent of conduit. Except where otherwise indicated, provide factory-fabricated bar hangers to support outlet boxes. When installation is performed in fire rated walls, maintain the wall's rating integrity by means of approved fire stop methods.

B. Do not install junction boxes back-to-back in walls. Maintain a minimum of 4" separation measured edge-to-edge between boxes. Where separation is not possible, install sound proofing material in boxes to minimize noise transfer between rooms. In fire rated walls, boxes may be no larger than 4" x 4" and are to be separated 24" minimum, measured edge-to-edge.

C. Outlet boxes installed in suspended or furred ceilings with steel runner or furring channels shall be supported.

D. Heights of outlets and equipment indicated on Drawings shall govern. In absence of such indications and if applicable to the project, the following heights shall be maintained with heights measured to centerline unless otherwise noted:

1. Install wall-mounted telephones, light switches, other switches, and fire alarm pull stations, 48 inches above finished floor. Refer to other Division 26 Sections.

2. Install power receptacle outlets, telephone outlets, and data outlets 18 inches above finished floor.

3. Install panelboards and terminal cabinets 6 feet-6 inches from finish floor to top of cabinet.

4. Install television outlets at a height corresponding to location of television monitor, or a minimum of 18 inches above finished floor. Refer to other Division 16 sections.

5. Install fire alarm horn/strobe or strobe lights 96 inches to top of light above finished floor.

3.03 COVER PLATES

A. Provide a plate on each outlet device as indicated or required. Plates shall be of stainless steel unless otherwise specified.

B. Flush wiring device and system outlets indicated to be blank covered, shall be covered with blank stainless steel plates. Flush lighting outlets to be blanked shall be covered with decorative, blank cover plates, painted to match surrounding finish. Provide stainless steel covers to blank indicated or required surface-mounted outlets.

C. In the following cases, and at required locations. Switch and receptacle plates shall be engraved with the device(s), or fixtures being controlled, or as indicated:.

1. Three-gang and larger gang switches.

2. Switches so located that operator cannot see fixtures, or items of equipment controlled while his hand is on the switch.

3. Switches not in same room with fixtures or items of unit heaters, air curtains, fly fans, etc.

4. Receptacles operating at other than 120 V shall be labeled with the operating voltage.

5. Where indicated on Drawings.

D. Designations shall be as indicated on Drawings or as specified by Architect.

3.04 IDENTIFICATION OF CIRCUITS AND EQUIPMENT

A. Provide descriptive nameplates or tags permanently attached to panelboards, circuit breakers, disconnect switches, starters, pushbutton control stations and other apparatus installed for operation or control of circuits, appliances, fire alarm control panel(s), fire alarm annunciator(s), power supplies, terminal cabinets, energy management control units, and Information technology system backbone and distribution equipment points. .

B. Provide nameplates of engraved laminated plastic, or etched metal. Submit Shop Drawings denoting dimensions and format to Architect before installation. Fasten to equipment with escutcheon pins, rivets, self-tapping screws, or machine screws. Self-adhering or adhesive backed nameplates are not permitted.

C. Fasten tags to feeder wiring in conduits at every point where runs are broken or terminated, including pull wires in empty conduits. Indicate circuit, phase, and function. Tag branch circuits in panel boards and cabinets. Tags may be manufactured of pressure-sensitive plastic or embossed self-attached stainless steel or brass ribbon.

D. Provide circuit identification cards and cardholders in all panel boards. Cardholders shall consist of metal frame retaining a clear plastic cover permanently attached to inside of panel door. List of circuits shall be typewritten on a card. Circuit description shall include name or number of circuit, area and connected load.

E. Junction and pull boxes shall have covers stenciled with box number when indicated on Drawings, or circuit numbers according to panel schedules. Data shall be lettered in a visible manner with a color contrasting with finish.

F. Name shall be correctly engraved, with a legend indicating function or areas, when required by codes or indicated on Drawings.

G. Provide wire marker indicating circuit number for each conductor located within each electrical panel, starter, disconnect, large junction box or trough, etc.

3.05 PROTECTION

A. Protect Work of this section until Substantial Completion.

3.06 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section

B. Section Includes: Lighting and power distribution facilities, including panelboards. Panelboards are existing as noted. Rearrange or install new breakers as noted.

C. Related Sections:

1. Section 26 01 00: Basic Electrical Requirements.

2. Section 26 51 00: Lighting.

1.02 SUBMITTALS

A. Provide in accordance with Division 01.

B. Shop Drawings: None required. All panels are existing.

1.03 DESIGN REQUIREMENTS

A. Panelboards:

1. Panelboards are existing unless noted otherwise.

2. Single pole branches shall be molded case, thermal magnetic circuit breakers with inverse time delay, trip free, quick-make, quick-break mechanism and silver alloy contacts. Circuit breakers shall be fully rated, with ampere rating marked on handle and shall indicate on/off and tripped positions. Ground fault interrupters shall be incorporated into circuit breakers where indicated. They shall be listed by UL, or other NRTL as ground fault devices. Provide appropriate lug kit of sufficient size to accommodate the feeders.

3. Two- and 3-pole branches shall be enclosed, and shall be thermal magnetic circuit breakers with inverse time delay, tamper-proof, ambient compensated, single handle, internal common trip, and quick-make, quick-break mechanism with silver alloy contacts. Circuit breakers shall be fully rated or as otherwise indicated on the Drawings.

4. Circuit breakers shall be fully rated and of one-piece, bolt-on type and shall meet short-circuit interrupting capacity requirements indicated on Drawings.

B. Panelboard Schedule: All panelboards shall have updated directories/schedules indicating loads being served. Provide a neatly typewritten schedule with number or name of room or area, or load served by each panelboard circuit. Room numbers or names shall be determined at the Project site and shall not necessarily be those indicated on the Drawings. Schedule shall also indicate panel designation, voltage and phase, building and distribution panel or switchboard from which it is fed. Schedule shall be installed in a frame under transparent plastic on inside of each panelboard door.

C. Panelboard Standards (if applicable): Panelboards shall be UL, or other NRTL listed and labeled. Panelboards shall meet latest revisions of following standards:

1. National Electric Code, Article 408.

2. UL 67, Panelboards.

3. UL 50, Cabinets and Boxes.

4. UL 943, GFCI.
5. UL 489, Molded Case Circuit Breakers.
6. NEMA PB1.
7. Federal Specifications W-P- 115C and WC-375B.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Where newly provided breakers or other components are installed, match existing equipment manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Panelboard locations shall provide sufficient working space around panels to comply with the National Electrical Code.

B. Unused openings in cabinets and disconnects shall be effectively closed as required by the manufacturer.

C. Cabinets shall be grounded as specified in Article 250 of the National Electrical Code.

D. Conduits shall be installed so as to prevent moisture or water from entering and accumulating within the enclosure.

E. Lugs shall be suitable and listed for installation with the conductor being connected.

F. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.

G. Maintain the required bending radius of conductors inside the cabinet.

H. Clean the cabinet of foreign material such as cement, plaster, and paint. Repaint to manufacturers original finish any blemishes that occur during construction.

I. Distribute and arrange conductors neatly in the wiring gutters.

J. Use the manufacturer's torque values to tighten lugs.

K. Follow manufacturer's instructions for installation.

3.02 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.03 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section

B. Section Includes:

1. Receptacles
2. Switches
3. Coverplates
4. Occupancy sensor switches

C. Related Sections:

1. Section 26 01 00: Basic Electrical Requirements.

1.02 SUBMITTALS

A. Provide in accordance with Division 01.

B. Shop Drawings:

a. Include manufacturer's cut sheets for each type device being installed listing description, manufacturer, and part number.

b. Include manufacturer's cut sheets for each device coverplate being installed listing description, manufacturer, and part number.

C. Installation Instructions: Submit manufacturer's written installation instructions including any warning labels and instruction manuals.

1.03 QUALITY ASSURANCE

A. Receptacles shall comply with NEMA WD 1, NEMA WD 6, and UL 498.

B. Switches shall comply with NEMA WD 1 and UL 20.

PART 2 - PRODUCTS

2.01 RECEPTACLES AND SWITCHES

A. Receptacles:

1. Color: Coordinate with architect

2. Duplex receptacles shall be heavy-duty specification grade, grounding type. Terminal screws shall be back and side wired with internal screw pressure plates. Mounting strap shall feature heavy-duty brass construction. Receptacle back body shall be PVC. Receptacle face shall be impact resistant nylon. Receptacles shall have triple wipe brass power contacts.

NEMA #	Pass & Seymour	Hubbell	Leviton
NEMA 5-20	PS5362	HBL5362	5362

3. Provide specification grade ground-fault circuit interrupter (GFCI) type receptacles in accordance with UL standards. GFCI receptacles shall have a trip indication light. Receptacle terminal screws shall be back and side wire with internal screw pressure plates. Test and reset buttons shall match device body in color. GFCI receptacles shall be manufactured in standard configuration for installation with stainless steel smooth plates. Exterior mounted receptacles shall be mounted inside weatherproof enclosure.

NEMA #	Pass & Seymour	Hubbell	Leviton
(20 amps) NEMA 5-20R	2094	GFR5352	8898

4. Provide specification grade arc-fault circuit interrupter (AFCI) type receptacles in accordance with UL standards. AFCI receptacles shall be tamper resistant and have a trip and reset button on the face of the device. Receptacle terminal screws shall be back and side wire with internal screw pressure plates. Test and reset buttons shall match device body in color. AFCI receptacles shall be manufactured in standard configuration for installation with stainless steel smooth plates.

NEMA #	Hubbell	Leviton
(20 amps) NEMA 5-20R	AFR20TR	AFTR2

5. Provide weatherproof receptacles, except where otherwise indicated or specified, consisting of GFCI receptacles, as specified herein, and metal plates with die-cast hinged, "in-use" covers and weatherproof mats.

6. Receptacles within 6 feet of water fountains, counter tops, or any sources of water shall be GFCI type.

7. Single receptacles shall be heavy-duty specification grade, grounding type. Terminal screws shall be back and side wire with internal screw pressure plates. Mounting strap shall feature heavy-duty brass construction. Receptacle back body shall be thermoplastic. Receptacle face shall be impact resistant nylon. Receptacles shall have triple wipe brass power contacts. For circuits consisting of one single receptacle only, ampere rating of receptacle shall be same as circuit breaker or fuse.

NEMA #	Pass & Seymour	Hubbell	Leviton
(20 amps) NEMA 5-20R	5361	HBL5361	5361

8. For equipment receptacles, provide 3-wire or 4-wire, non-grounding type, rated 30 amps or 50 amps at 125/250 volts, NEMA 10-30R or 10-50R, with 2-gang stainless steel plates. Refer to drawings.

B. Switches:

1. Color: Coordinate with architect

2. Local Switches:

a. Provide local switches, high strength thermoplastic toggle, specification grade, rated 20 amps at 120-277 volts AC only, with plaster ears, external screw pressure plate back and side wired, and standard size composition cups which fully enclose mechanism. Switches shall be approved for installation at currents up to full rating on resistive, inductive, tungsten filament lamp and fluorescent lamp loads, and for up to 80 percent of rating for motor loads. Switches shall have oversized silver alloy contacts for long life and better heat dissipation. Provide switches as single pole, double pole, 3-way, 4-way, non-lock type.

	Pass & Seymour	Hubbell	Leviton
Single pole	PS20AC1	HBL1221	1221-2
Double pole	PS20AC2	HBL1222	1222-2
Three way	PS20AC3	HBL1223	1223-2
Four way	PS20AC4	HBL1224	1224-2

3. Dimmer Switches: Provide dimmers switches to be completely compatible with fixtures and loads being controlled. Color shall be the same as other devices.

C. Occupancy sensor switches (CEILING OR WALL MOUNT):

1. Control Specifications
   a. Adjustment: Self-Adjusting
   b. Manual Time Adjustment: 30 sec to 30 min
   c. Timer Factory Preset: 10 Minutes
   d. Sensitivity Adjustment: 0 to 100 Pct
   e. Sensitivity Factory Preset: Ultrasonic 50 Pct Infrared 75 Pct
   f. Photo Cell Adjustment: 20 to 3000 Lux
   g. Single/Multi-Tech Mode: Switchable ON/OFF PIR/ULTRA
2. Electrical Specifications
   a. Input Voltage: 120/277 volt
   b. Current Consumption: 30-50mA
   c. Output Voltage: 120/277 volt
3. Material Specifications
   a. Color: match other devices
   b. Housing Material: High-Impact, Injection Molded Plastic
   c. LED Indicator: Red Infrared Motion & Green Ultrasonic Motion
   d. PIR Lens Type: Extended Range
   e. Wire Leads: Color Coded 6 Inch
4. Mechanical Specifications
   a. Sensor Technology: PIR/Ultrasonic 32kHz
   b. Pattern Degrees: 360
   c. Coverage (Sq.Ft.): 1000 or 2000 Sq. Ft. or linear coverage for corridors
5. Wall mount switches shall have a manual off override function.

PART 3 - EXECUTION

3.01 INSTALLATION OF DEVICES

A. Installation shall be in accordance with the NEC and as shown as on the drawings.

B. Install AFCI, tamper proof receptacles in all residence rooms.

C. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the green equipment grounding conductor.

D. Ensure that devices and their boxes are protected until completion of project.

E. Do not install junction boxes back-to-back in walls. Maintain a minimum of 4" separation measured edge-to-edge between boxes. Where separation is not possible, install sound proofing material in boxes to minimize noise transfer between rooms. In fire rated walls, boxes may be no larger than 4" x 4" and are to be separated 24" minimum, measured edge-to-edge.

F. Do not cut holes for boxes with routers that are designed to ride along the inside of device back box. Replace any damaged wiring from router cut outs.

G. Keep outlet boxes free of plaster, drywall compounds, mortar, cement, paint, dust, or other materials that may contaminate the devices, conduits, wiring, cables, etc.

H. Install device boxes in brick or block walls so the cover plate does not cross a joint unless the joint is toweled flush with the face of the wall.

I. Cut outs around device boxes shall be completed such that a standard faceplate completely covers the cut out. Walls shall be patched accordingly where oversize cut outs occur.

J. Install proper size and depth tile extension rings at outlet back boxes based on wall types and thickness.

K. Do not install wiring devices until all wall preparation, painting, finishing, is complete.

L. Do not strip insulation from wiring until devices are being installed.

M. Replace any devices that have been damaged or show signs of use during construction phase of project before finishes were complete.

N. Keep devices in their package or protected until time of installation.

O. Connect devices using pigtail connections of not less than 6". Where conductors larger than #12 AWG have been installed, use #12 AWG for pigtail connections to devices.

P. Remove fiber or plastic washers prior to installation to ensure metal-to-metal contact.

Q. Outlet boxes for light switches shall be mounted on the strike side of doors, unless shown otherwise.

R. Provide barriers in multigang outlet boxes to separate systems of different voltages, Normal Power and Emergency Power systems, and in compliance with the NEC.

S. Coordinate with other work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other work. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work, and in connection with laboratory equipment.

T. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Contractor shall coordinate exact field location of the above items with other trades. In addition, check for exact direction of door swings so that local switches are properly located on the strike side.

U. Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

V. Test GFCI devices for tripping values specified in UL 1436 and UL 943.

W. Heights of outlets and equipment indicated on Drawings shall govern. In absence of such indications and if applicable to the project, the following heights shall be maintained with heights measured to centerline unless otherwise noted:

1. Install wall-mounted telephones, light switches, other switches, and fire alarm pull stations, 48 inches above finished floor. Refer to other Division 26 Sections.
2. Install power receptacle outlets, telephone outlets, and data outlets 18 inches above finished floor.
3. Install television outlets at a height corresponding to location of television monitor, or a minimum of 18 inches above finished floor. Refer to other Division 26 sections.
4. Install fire alarm horn/strobe or strobe lights 96 inches to top of device above finished floor.

X. Where ceiling occupancy sensors are shown in the same area as toggle switches, connect lighting to be auto controlled by sensor device, but manual override by wall mounted switch.

3.02 COVER PLATES

A. Provide a plate on each outlet device as indicated or required. Plates shall be of stainless steel unless otherwise specified.

B. Flush wiring device and signal system outlets indicated to be blank covered, shall be covered with blank stainless steel plates. Flush lighting outlets to be blanked shall be covered with decorative, blank cover plates, painted to match surrounding finish. Provide stainless steel covers to blank indicated or required surface-mounted outlets. All flush wiring device and outlet boxes that are not utilized, shall have a blank cover plate.

C. In the following cases, and at required locations. Switch and receptacle plates shall be engraved with the device(s), or fixtures being controlled, or as indicated:.

1. Three-gang and larger gang switches.
2. Switches so located that operator cannot see fixtures, or items of equipment controlled while his hand is on the switch.
3. Switches not in same room with fixtures or items of unit heaters, air curtains, fly fans, etc.
4. Receptacles operating at other than 120 V shall be labeled with the operating voltage.
5. Where indicated designations shall be as indicated on Drawings or as specified by Architect.

3.03 PROTECTION

A. Protect Work of this section until Substantial Completion.

3.04 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

END OF SECTION

SECTION 26 28 16 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section

B. Section Includes: Disconnect switches.

C. Related Sections:

1. Section 26 01 00: Basic Electrical Requirements.
2. Section 26 24 16: Panelboards.

1.02 SUBMITTALS

A. Provide in accordance with Division 01.

B. Shop Drawings: Include dimensions, make, capacity of equipment, size, rating, and catalog number. Vendor cut sheets of devices in enclosure and bill of materials listing description, manufacturer, part number, and quantity of items shall be included.

C. Installation Instructions: Submit manufacturer's written installation instructions.

1.03 DESIGN REQUIREMENTS

A. Disconnect Switches:

1. In accordance with UL 98, NEMA KS1, and NEC.
2. Shall be HP rated.
3. Fusible Switch, 600 amp and smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses or recommended fuses, lockable handle; interlocked with cover in closed position.
4. Shall have the following features:
    a. Switch mechanism shall be the quick-make, quick-break type.
    b. Copper blades, visible in the OFF position.
    c. An arc chute for each pole.
    d. External operating handle shall indicate ON and OFF position and have lock-open padlocking provisions.
    e. Mechanical interlock shall permit opening of the door only when the switch is in the OFF position, defeatable to permit inspection.
    f. Fuse holders for the sizes and types of fuses specified.
    g. Electrically operated switches shall only be installed where shown on the drawings.
    h. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
    i. Ground lugs for each ground conductor.
    j. Enclosures:
        i. Shall be the NEMA types shown on the drawings for the switches.
        ii. Where the types of switch enclosures are not shown, they shall be the NEMA types most suitable for the ambient environmental conditions. Unless otherwise indicated on the plans, all outdoor switches shall be NEMA 3R.

iii. Shall be finished with manufacturer’s standard gray baked enamel paint over pretreated steel (for the type of enclosure required).

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Disconnect switches shall be manufactured by General Electric, Eaton, Square D, Siemens, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Disconnects/Safety switches shall be installed in the vertical position with "ON" at the up position and top of the switch.

B. Disconnects/Safety Switches shall be securely fastened to wall or structural member by at least 4 points. Where structural support is not present, uni-strut shall be installed for additional support and points-of-contact.

C. Unused openings in cabinets and disconnects shall be effectively closed as required by the manufacturer.

D. Cabinets shall be grounded as specified in Article 250 of the National Electrical Code.

E. Conduits shall be installed so as to prevent moisture or water from entering and accumulating within the enclosure.

F. Lugs shall be suitable and listed for installation with the conductor being connected.

G. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.

H. Maintain the required bending radius of conductors inside the cabinet.

I. Clean the cabinet of foreign material such as cement, plaster, and paint. Repaint to manufacturers original finish any blemishes that occur during construction.

J. Distribute and arrange conductors neatly in the wiring gutters.

K. Use the manufacturer's torque values to tighten lugs.

L. Before energizing disconnect switches, the following steps shall be taken:

1. Retighten connections to the manufacturer's torque specifications. Verify that required connections have been provided.
2. Remove shipping blocks from component devices and panelboard interiors.
3. Remove debris from switch interior.

M. Follow manufacturer's instructions for installation.

N. Do not install in highly corrosive environments, unless rated for the application.

3.02 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.03 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 51 00 - LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of the General and Supplementary Conditions and Division 01 apply to this section.

B. Section Includes: Furnishing and installing lighting fixtures, including lamps, ballasts, wiring, and lighting controls.

C. Light fixtures model numbers were determined at the time this specification was written; model numbers may need to be modified, or may require the addition or deletion of options to fully meet specification requirements.

D. Related Sections:

1. Section 26 01 00: Basic Electrical Requirements
2. Section 26 05 33: Raceway and Boxes for Electrical Systems.

1.02 SUBMITTALS

A. Provide in accordance with Division 01.

B. List of Materials: Submit a complete list of materials proposed for this section.

C. Shop Drawings: Provide detailed and dimensioned Shop Drawings or manufacturer’s data sheet with specific model and part numbers indicating kind, weight and thickness of materials, method of fitting and fastening parts together, location and number of sockets, size of lamps, and complete details of method of fitting suspension and fastening fixtures in place.

D. Submittals must comply with contract general provisions.

1.03 MOUNTING REQUIREMENTS

A. Design of lighting fixtures, accessories, supports, and method of fixture installation shall comply with requirements of ceiling type which fixture is installed.

B. Provide suspension points at no more than 2 feet from fixture ends. Spacing between supports shall not exceed 8 feet.

C. For fixtures mounted in grid ceiling, provide fixture supports at all (4) corners of the fixture independent of ceiling grid system, or manufacturer’s approved ceiling support system.

1.04 QUALITY ASSURANCE

A. Components and fixtures shall be listed and approved for the intended application by Underwriter's Laboratories (UL), or other Nationally Recognized Testing Laboratory (NRTL).

B. Owners approval shall be obtained for any equipment or materials substitutions.

1.05 GUARANTEE

A. Provide a 1 year labor warranty.

B. Provide material warranty as specified:

1. Lamps: 1 years
2. Ballasts: 5 years
3. Standards: 1 year
4. Controls: 3 years

C. Warranty period begins at substantial completion or project acceptance for beneficial occupancy.

PART 2 - PRODUCTS

2.01 MATERIAL AND FABRICATION

A. Lighting fixtures shall be the type indicated on Drawings and as specified. Fixtures of same type shall be of one manufacturer.

B. Fixtures shall be of the types and manufacturers described in the Luminaire Schedule of the Drawings, with lamps, wattage and voltage as indicated. Alternate fixtures must be submitted for approval minimum 2 weeks prior to project bid date.

C. All fixtures shall be baked-on enamel or powder-coated, unless otherwise specified in subsections below.

2.02 LAMPS AND BALLASTS

A. LED Fixtures, Driver, and Characteristics

1. LED Fixture
    a. Cast aluminum heat sink integrated directly with housing.
    b. Replaceable PC board with quick connects.
    c. High lumen output LED's with 50,000 hours life expectancy.
    d. No lead or mercury.
2. Optics System
    a. Computer-optimized internal reflector with specular finish with diffusing lens to conceal the LED's for uniform luminance.
    b. Low glare, 900 lumens minimum.
3. LED Driver
    a. Non-dimming and optical 0-10V dimming driver accommodating 120 or 277 volts AC at 60 Hz.
    b. Power factor 0.9 minimum.
    c. Driver to accept 120 or 277 volts AC.

2.03 TIME CLOCK

A. Furnish and install where shown a Time Switch as manufactured by TORK, or equal.

B. Characteristics

1. 24 hour dial and day-omitting device
2. Powered by a self-starting synchronous motor
3. Contacts shall be capable of switching 40 amperes per pole continuously at rated voltage.
4. Time Switch shall be DPST.

5. Removable ON-OFF trippers shall make possible automatic operation with a minimum ON period of 20 minutes and a minimum of 2 hours between one OFF period and the next.
6. Enclosure shall be NEMA 1 surface type, finished in beige enamel, with combination 1/2”, 3/4” knockouts on bottom, both sides and back.
7. Provision shall be made for positive padlocking.
8. Terminals shall be capable of receiving #8 AWG wire.
9. Time Switch shall be equal to TORK Model 7200 for 120 volt systems or 7202 for 277 volt systems.

2.04 POLES

A. Pole mounted fixtures shall be provided as noted on drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install a lighting fixture for each lighting outlet indicated and mark new ballasts with day of installation.

B. Fixture voltage shall be as indicated on Drawings.

C. Install recessed and surface-mounted fixtures, with plaster frames compatible with ceiling and wall systems employed; secure fixtures mechanically to frames.

D. Align rows of suspended and surface-mounted fixtures to form straight lines at uniform elevations.

E. Recessed fixtures shall fit snugly against ceilings to prevent light leakage.

F. Support suspended recessed fixtures in T-bar ceilings. Fixture installation shall be coordinated with acoustical ceiling installation.

G. Continuous suspended fixtures:

1. Fixture suspension device shall allow vertical adjustment of fixture without the use of tools. Cable shall be minimum 7 strand twisted stainless steel capable of supporting minimum four times the fixture weight. For continuous linear suspended fixtures longer than eight feet, provide not less than three suspension points.
2. Top of fixture shall be suspended as shown on the Drawings, typically 24 inches below the ceiling and a minimum of 18 inches from the ceiling.
3. Fixture shall utilize factory furnished or approved hardware and canopy for either hard or T-bar ceilings.

H. Where emergency battery packs are installed, provide constant hot for emergency fixtures. Unless noted otherwise, when powering unit inverter power packs, use the same circuit that powers the switched ballast to power the inverter.

I. Where emergency ballast(s) are specified within the fixture, provide constant hot for the ballast(s). Nonemergency ballasts within the same fixture shall be switched as indicated, unless noted otherwise.

J. Surface mount fixtures shall be attached to structure. Toggle bolts are NOT permitted. Provide backing where required.

K. Poles shall be installed as detailed on the drawings.

L. Poles shall be installed level and plumb.

3.02 TESTING

A. Check and adjust fixtures for required illumination.

B. Replace defective lamps and ballasts.

C. Test and adjust lighting control equipment for proper operation.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.04 CLEANUP

A. Remove rubbish, debris, and waste materials from all areas of work each day.

B. Clean fixture surfaces of dirt, cement, plaster and debris. Furnish cleansers compatible with material surfaces being cleaned.

3.05 HAZARDOUS WASTE DISPOSAL

A. All hazardous waste disposal shall be handled and disposed of by an approved, licensed contractor.

B. Any and all ballasts are assumed to contain PCB unless clearly marked “NO PCB.”

C. Place ballasts and lamps in appropriate containers provided by hazardous waste contractor labeled clearly with:

1. Project Name

2. Quantity of ballasts and lamps

3. Date ballasts and lamps became waste

D. Store, remove, transport and dispose of hazardous materials in all accordance with state and federal regulations.

E. Provide Owner with copy of manifest and certificate of destruction.

END OF SECTION

SECTION 27 15 00 – COMMUNICATIONS - ROUGH-IN

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pathways.
2. Backboard

B. Contractor will provide rough-ins, conduits, boxes, raceways, grounding, etc. as noted on drawings and in specifications. All wiring, devices, racks, and terminations will be by others.

1.02 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling conduit system shall comply with transmission standards in TIA/EIA.

1.03 SUBMITTALS

A. None

PART 2 - PRODUCTS

2.01 PATHWAYS

A. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceways and Boxes."

1. Outlet boxes shall be no smaller than 4 inches wide, 4 inches high, and 2-1/2 inches deep.
2. Extend ¾" minimum conduit from each device box to above the accessible ceiling. Provide larger conduits where noted on drawings.

2.02 BACKBOARDS

A. Backboards: Existing to remain.

PART 3 - EXECUTION

3.01 ENTRANCE FACILITIES

A. Coordinate service entrance conduits with details and notes on drawings.

B. Install conduit extensions into pull box where noted.

C. Provide ground bar and extend minimum of #4 AWG copper conductor (or larger as noted on drawings) from the ground bar to the service entrance ground.

3.02 INSTALLATION OF PATHWAYS

A. Drawings indicate general arrangement of devices, pathways and fittings.

B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

C. Comply with requirements in Division 26 Section "Raceways and Boxes" for installation of conduits and wireways.

D. Install manufactured conduit sweeps and long-radius elbows whenever possible.

E. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.

2. Secure conduits to backboard when entering room from overhead.

3. Extend conduits 3 inches above finished floor.

4. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

F. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints. Paint with (2) coats of fire retardant white paint.

G. Install conduits from each device as indicated and stub to above the accessible ceiling or extended into telecom space as noted on drawings.

3.03 FIRESTOPPING

A. Comply with requirements in Division Section "Through-Penetration Firestop Systems."

B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion

3.05 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site

END OF SECTION

SECTION 28 13 53 - IP NETWORK COMPATIBLE INTERCOM/DOORBELL (IX SYSTEM)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. IP Video Intercom. (Aiphone IX Series)

1.02 REFERENCES

A. American National Standards Institute (ANSI/TIA/EIA) 568 - Commercial Building Telecommunications Cabling Standard.

B. International Organization for Standards (ISO) 9001:2000 - Quality Management Systems - Requirements.

1.03 SYSTEM DESCRIPTION

A. IP Network Compatible Video Intercom System: A network-based communication and security system featuring video entry security, internal communication, emergency stations, and paging. All units and app in the systems shall be able to unlock doors remotely on a network, assist onsite visitors from an offsite location, broadcast emergency announcements, and communicate using a PoE network.

1. Power Source: Power over Ethernet (802.3af).
2. Network Interface: 10 BASE-T / 100 BASE-TX Ethernet (RJ-45).
3. Network Protocols: IPv4, Ipv6, TCP, UDP, SIP, HTTP, HTTPS, MJPEG, RTSP, RTP, RTCP, IGMP, MLD, SMTP, DHCP, NTP, DNS.
4. Bandwidth Usage:
   a. G.711: 64Kbps x 2 per video call.
   b. 64Kbps per monitor.
   c. H.264: 24Kbps ~ 2,048Kbps.
5. Communication: Hands-free (VOX), push-to-talk (simplex), or handset (full-duplex).
6. Video Display: 7-inch color LCD.
7. Camera: Type:
   a. 1/3-inch color CMOS. 1.23 Megapixels.
   b. View Area at 0-degree camera angle mounted at 4 feet 11 inches (1500 mm) AFF: 2 feet 3 inches (700 mm) vertical x 3 feet 9 inch (1150 mm) horizontal at 19 inches (500 mm).
8. Video Stream: ONVIF Profile S.
9. Door Release: Programmable Form C dry contact, 24V AC/ DC, 1A (use RY-1824L for larger contact rating, which requires a 24V DC power supply) or use IXW-MA with 10 multipurpose relays.
10. Wire Type: CAT-5e or CAT-6.
11. Distance:
    a. Any station to Network Node: 330 feet (100 meters).

1.04 SUBMITTALS

A. Provide in accordance with Division 01.

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: Submit the following:
   1. Wiring Diagrams: Indicate wiring for each item of equipment and interconnections between items of equipment.
   2. Include manufacturer's names, model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.

D. Installation and Operation Manuals:
   1. Submit manufacturer's installation and operation manual, including operation instructions and component wiring diagrams.
   2. Provide detailed information required for Owner to properly operate equipment.

E. Warranty: Submit manufacturer's standard warranty.

F. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

G. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001:2015 certified company.

B. Installer Qualifications: Factory trained and experienced with system installations of scope and size required for the Project.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship is approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials during handling and installation to prevent damage.

1.07 PROJECT CONDITIONS

A. 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. Acceptable Manufacturer: Aiphone Corp., which is located at: 6670 185th Ave. NE; Redmond, WA 98052 ; Toll Free Tel: 800-692-0200; Tel: 425-455-0510; Fax: 425-455-0071; Email: request info (marketing@aiphone.com); Web:http://www.aiphone.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

C. IP Video Intercom System: IX Series Intercom System as manufactured by Aiphone Corporation.

2.02 SYSTEM DESIGN

A. Master Stations:
   1. Model IX-MV7-HB (Black chassis - Handset)

B. Audio Video Door Stations:
   1. Model IX-DV (Video Door Station - Surface Mount - Vandal Resistant)

C. Provide Selective Door/Gate Release. Door release shall integrate with door access controls, coordinate with campus IT department.

D. Provide Contact input at door station.

2.03 FUNCTIONAL COMPONENTS:

A. Functional Components: As indicated on the drawings or as required to complete system.
   1. Video Master Station Series IX-MV7:
      a. Model IX-MV7-HB (Master Station - Black w/Handset).
   2. IP Programmable Relay Adaptor IXW-MA:
      a. 4 contact inputs and 10 relay outputs.
   3. 2-Wire Network Adapter Model IX-10AS (Ten IX-1AS adaptors in a rack mounted enclosure):
      a. Ten 2-wire inputs with ten, 2 built-in contact outputs; door release and camera call-up. Powered via PoE, Compatible with Aiphone LE and NE series audio door or substations for connection to Video Master Station Model IX-MV7 over a network.
   4. 30 Degree Angle Box Model SBX-IXDV30:
      a. Designed for use with IX-DV video door station.

PART 3 – EXECUTION

3.01 EXAMINATION

B. Examine areas to receive integrated security and communication system.

C. Notify Architect of conditions that would adversely affect installation or subsequent use.

D. Do not begin installation until unacceptable conditions are corrected.

3.02 PREPARATION

A. Verify the following compliance before starting installation.

1. The unit turns inoperative during power failure.
2. Keep the intercom wires at least 1 foot (30 cm) away from strong electrical wiring (AC 100-240 V) including, in particular, wiring for inverter electrical appliances. Noise and malfunction could result.
3. If a strong light shines on the main unit screen, the picture may turn white or only silhouettes will be visible.
4. Other manufacturer's devices (such as sensor, detectors, door releases) used with this system, comply with the manufacturer's installation requirements.
5. The LCD panel is manufactured with very high precision techniques, inevitably will have a very small portion of its picture elements always lit or not lit at all. This is not considered a unit malfunction. Please be aware of this in advance.

3.03 INSTALLATION

A. Install integrated security and communication system in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Mount equipment plumb, level, square, and secure. For video entrance stations and video door stations, comply with manufacturer's design requirements to provide optimum picture quality of station monitoring.

3.04 SET-UP AND ADJUSTING

A. Adjust integrated security and communication system for proper operation in accordance with manufacturer's instructions.

3.05 DEMONSTRATION AND TRAINING

A. Demonstration:

1. Demonstrate that integrated security and communication system functions properly.
2. Perform demonstration at final system inspection by qualified representative of manufacturer.

B. Instruction and Training:

1. Provide instruction and training of Owner's personnel as required for

operation of integrated security and communication system.

2. Provide hands-on demonstration of operation of system components and complete system, including user-level program changes and functions.
3. Provide instruction and training by qualified representative of manufacturer.

3.06 PROTECTION

A. Protect installed integrated security and communication system from damage during construction.

B. Protect the Work of this section until Substantial Completion.

3.07 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 28 31 00 - FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section

B. Section Includes:

1. Fire alarm system shall consist of one fire alarm control panel or networked nodes, of the same make and listed for the application as indicated in drawings.

2. All labor, equipment, materials, connections, testing, and performance of operations in the installation of fire alarm system as indicated on Drawings or as specified herein.

C. Related Sections:

1. Heating, Ventilating, and Air Conditioning Equipment.

2. HVAC Instrumentation and Controls.

3. Section 26 01 00: Basic Electrical Requirements.

4. Section 26 05 19: Low-Voltage Electrical Power Conductors

5. Section 26 05 26: Grounding and Bonding.

6. Section 26 05 33: Raceways and Boxes for Electrical Systems.

1.02 SYSTEM REQUIREMENTS

A. Fire detection system shall continually supervise and monitor the following initiating, signaling, and monitoring circuits:

1. Manual fire-pull stations.

2. Smoke and duct detectors, including those installed under other sections.

3. Alarm signaling circuits including alarm bells, horns and visual alarm units.

4. Annunciators.

5. Power supplies and batteries.

B. System controls shall be UL listed for power limited applications in accordance with National Electrical Code.

C. The fire alarm devices and equipment shall be listed for installation for the fire alarm control panel to which they are being connected.

D. Complete installation shall conform to the current version of NFPA 72, Local Fire Codes and Building Code, and National Electrical Code (NEC).

E. System labels and devices programming addresses shall be based on final signage and building labeling submittals. For existing facilities contractor shall obtain from Owner Authorized Representative a copy of the current site layout and building labeling designations.

1.03 CERTIFICATION

A. Certification: Installation of fire alarm system shall not begin until Shop Drawings are submitted and reviewed by the Architect. Written certification by fire alarm equipment distributor or manufacturer shall be submitted to the Architect stating that system and its component parts are as approved and listed by the authority having jurisdiction, and that the design conforms to requirements set forth by the construction documents.

1.04 PERFORMANCE

A. System shall be fully programmable, configurable, and expandable in the field without special tools or PROM programmers and shall not require replacement of memory components. Installer shall provide a CD of all system installed software, site specific system programming and all information and tools required to re-program or modify the system.

1.05 SYSTEM FUNCTIONAL OPERATION

A. When a fire alarm condition is detected by one of the system alarm initiating devices, the following functions shall occur:

1. System alarm LED shall flash.
2. Local sounding device in panel shall be activated.
3. The LCD display shall indicate type of device, custom label location label and point status alarm condition.
4. Appropriate change of status message shall be transmitted to remote annunciator(s).
5. Automatic programs assigned to alarm point shall be executed and associated indicating devices and relays activated.
6. In response to a fire alarm condition, the system will process all control programming and activate all system outputs (alarm notification appliances and/or relays) associated with the point(s) in alarm. Additionally, the system shall send events to a central alarm supervising station via either dial-up over public switched telephone network (PSTN) or internet via public switched data network (PSDN) or virtual private network.
7. In the event of a fire alarm control panel activation, all manual and automatic electronic tone or electromechanical bell class passing signals shall be disabled.
8. In the event of a fire alarm condition the Central and Autonomous Public Address System shall be overridden, if applicable.
9. Provide all necessary hardware and labor for a complete and tested interfacing of the fire alarm system with the lighting controls systems, where applicable; lighting in these areas shall be brought to full brightness in the event of a fire alarm.
10. Provide all necessary hardware and labor for a complete and tested interfacing of the fire alarm system with the audio controls systems, where applicable; audio devices in these areas shall be silenced in the event of a fire alarm

B. Trouble and Supervisory Conditions.

1. When any trouble condition is detected the following functions shall occur:

a. System trouble LED shall flash.

b. Local sounding device in panel shall be activated.

c. The LCD display shall indicate the type of trouble and custom label location associated with the trouble condition and its location. Unacknowledged alarm messages shall have priority over trouble messages. If such an alarm is displayed, then trouble messages shall not be displayed.

d. Appropriate message shall be transmitted to remote annunciators.

C. When any supervisory condition occurs such as a sprinkler valve tamper, the following function shall occur:

1. System supervisory LED shall flash.

2. Local sounding device in panel shall be activated.

3. Appropriate message shall be transmitted to remote annunciators.

D. Activation of control panel ACKNOWLEDGE switch in response to a single new alarm, trouble or supervisory condition shall silence panel sounding device and change system alarm, trouble, or supervisory LED from flashing to steady-ON. If additional new alarm, trouble, or supervisory conditions exist in the system; activation of this switch shall advance display to next alarm, trouble, or supervisory condition that exists, and shall not silence local audible device or change LED to steady until new conditions have been so acknowledged. New alarm conditions shall always be displayed before new trouble conditions. Occurrence of a new alarm, trouble, or supervisory condition shall cause panel to resound, and sequences as described above, shall repeat.

E. Activation of the signal SILENCE switch shall cause appropriate notification (indicating) appliances and relays to return to normal condition. Selection of notification appliance circuits and relays silenced by this switch shall be fully programmable.

F. Activation of system RESET switch shall cause electronically latched initiating devices or zones, as well as associated output devices and circuits, to return to normal condition after sixty seconds of alarm. If alarm conditions exist in system after system reset switch activation, system shall then re-sound alarm conditions as indicated hereafter.

G. Activation of lamp test switch shall turn on LED indicators, LCD display, and local sounding device in panel, and then return to previous condition.

H. Fire alarm indicating appliances may be silenced or extinguished, after one minute, by operating signal silence switch at the FACP or by use of key supervised alarm silence switch at remote annunciators. A subsequent zone alarm shall reactivate signals. Audible indicating appliances shall be automatically silenced after no less than 5 nor more than 10 minutes of operation. Visual indicating appliances shall be extinguished at system reset, or automatically after no less than 5 nor more than 10 minutes of operation. Fire sprinkler flow alarm bells shall not silence until the contacts in the fire sprinkler flow switch return to the normal non-alarm state. Appropriate signage must be installed on or next to the sprinkler alarm bell.

I. All system’s circuits including but not limited to initiation, indicating, and equipment interfacing shall be monitored for open/short circuit and ground fault conditions, these

conditions shall be indicated on the Fire Alarm Control Panel and Annunciator displays while remaining circuits continue to operate normally.

J. All notification appliance circuits shall be silenceable for testing purposes by authorized persons. Protected pass-codes, keys, or another secure method that does not require entering into the system programming shall be used.

K. System shall be programmed that during an alarm event or a trouble event, that campus police shall be notified via an auto-dialer with pre-programmed message stating status of alarm condition.

1.06 POWER REQUIREMENTS

A. The fire alarm control panel and remote power supply shall receive 120 VAC power, 60 Hz, through a dedicated 20 amps circuit. Circuit breaker protection for the dedicated fire alarm power circuits shall be equipped with a handle lock-on device, the breaker handle shall be colored red and labeled “FIRE ALARM”. Clearly label the Electrical panel name, location and circuit number on the inside of the fire alarm control panel and all remote power supplies using a p-touch style labeling system. Transient voltage surge suppression shall be provided at the 120VAC input terminal.

B. System shall be provided with sufficient battery capacity to operate entire system upon loss of normal 120 VAC power, in a normal quiescent mode, for a period of 24 hours with 5 minutes of alarm indication at end of this period. System shall automatically transfer to standby batteries upon power failure. Battery charging and recharging operations shall be automatic. Batteries, once discharged, shall recharge at a rate to provide a minimum of 70 percent capacity in 12 hours.

C. Circuits requiring system operating power shall be 24 VDC and shall be individually protected at control panel.

1.07 SUBMITTALS

A. Provide in accordance with Division 01.

B. Component Plan Submittal: Availability and listing for its application shall be verified for all system components before presentation of the submittal. Include the following information and details as applicable:

1. Installer name, address, telephone number.
2. List of system components, equipment and devices, including manufacturer model numbers, quantity, mounting heights, and symbols per symbol list.
3. Copies of manufacturer specification sheets for equipment and devices indicated. Highlight or identify the specific components on Catalog cut sheets.
4. Voltage Drop Calculations: Include the following information for the worst case:
    a. Point-to-point or Ohms law calculations.
    b. Zone used in calculations.
    c. Voltage drop percent. Voltage drop shall not exceed manufacturer’s requirements. If voltage drop exceeds 10 percent, indicate manufacturer listed operating voltage ranges for equipment and devices.
5. Battery types, amp hours, and load calculations including the following:
    a. Normal operation: 100 percent of applicable devices for 24 hours to equal control panel amps plus list of amps per device that draw

power form the panel during standby power condition including, but not limited to, zone modules, detectors and devices as identified.

b. Alarm condition: 100 percent of applicable devices for 5 minutes to equal control panel amps plus list of amps per device that draw power from panel during alarm condition including, but not limited to, the following:

(1) Zone modules.

(2) Signal modules.

(3) Detectors.

(4) Signal devices.

(5) Annunciator.

(6) Other devices as identified.

c. Normal operation plus alarm operation load calculation shall include total amp hours required and total amp hours provided.

6. Provide one copy of testing procedures.

C. Shop Drawings: Provide Shop Drawings, in the same size as the design Drawings, Shop Drawings shall include the following:

1. Provide drawing scale, elevations of all system enclosures, and actual layout of the Fire Alarm Control Panel, power supply, annunciator, and all main system components.

2. Plan indicating all related fire equipment to be monitored or supervised; main equipment such as control panels, power supplies, annunciators, and components such as outdoor wall-mounted horns, sprinkler bells, pull boxes, underground pull boxes , wiring routes on buildings exterior and underground locations. In each conduit or raceway run indicate conduit sizes, and quantities and type of wires.

3. Complete battery calculations, and voltage drop calculation shall be included; these calculations shall be based on the devices maximum UL current rating.

4. One line drawing for the entire system network indicating all system components and wiring. The one line diagram shall show but not be limited to panel to panel interconnections, conductors gauge and quantity, conduit size and type (designation) and specific function.

5. System panel one-line drawings indicating the quantity and type (designation) of conductors entering and exiting the fire alarm terminal cabinet in each building (enclosure) for initiating, notification, or other command control functions required for complete system operation:

a. Individual floor/building plan view drawings indicating all device locations including end of line resistors “EOLR” in accordance with the legend provided.

b. Individual point addresses for all initiation and notification devices.

c. Device “typical” wiring diagrams. These drawings shall indicate specific termination details for all peripheral equipment and/or interface devices.

6. Provide interfacing with equipment furnished by others including voltages, and other required coordination items.

7. Each of the pictorial diagrams included shall appear identical to the products they are intended to depict, in order to speed installation of the system, and to enhance the accuracy of the installation Work. Typical wiring diagrams or catalog sheets are not permitted.

8. Background Drawings with device locations are available in electronic format and may be obtained with permission from the Architect and Engineer. Contractor is solely responsible for the accuracy and completeness of shop drawings. Buildings that are not part of the contract shall be clearly identified "NOT IN CONTRACT". Shop Drawings shall be prepared in the latest version of AutoCAD with 3 – CD ROM electronic copies submitted along with full sized Shop Drawings.

9. Other installation and coordination drawings specifically related to this section shall be included as follows:

   a. Size A (8-1/2 inch x 11 inches) and size B (11 inch x 17 inch) shall be bound into the manual.

   b. Larger drawings shall be folded and inserted into transparent envelopes and bound into the manual.

10. Installation and coordination drawings for items in other sections shall be included with submittal of Shop Drawings. Submit copies of installation and coordination drawings.

11. Samples: Provide Samples of material and equipment as required by the Architect. If Samples are requested, they shall be submitted within 10 days from date of request.

D. In addition to the above requirements, provide submittals to meet any additional requirements of Architect or Owner.

E. Submittal of Equivalent Systems:

1. In addition to the submittal requirements of this section, if an equivalent system listed in Section 2.01A is submitted in lieu of the designed system shown on approved drawings, the Contractor shall also submit a letter stating that the system is equivalent, and that device locations and quantities of devices are unchanged. Attached to this letter shall be a copy of the revised equipment schedule with corresponding part numbers and a cut sheet for each item.

1.08 QUALITY ASSURANCE

A. Installer shall have successfully completed at least 5 projects of equal scope in the past 5 years, and have been in business of furnishing and installing fire alarm systems of this type for at least 5 years.

B. Installer shall be a factory authorized distributor and service provider for the brand of equipment offered and shall provide documentation to the Architect upon request.

C. Installer shall maintain a fully equipped service organization capable of furnishing repair service to the equipment and shall maintain a spare set of major parts for the system at all times.

D. All materials and equipment installed shall be new.

E. All of the equipment in this specification shall be furnished and installed by the Authorized Factory Distributor of the equipment.

F. Installer shall certify that the installation has been made in accordance with UL requirements.

G. Contractor/Installer's electricians and fire/life safety technicians shall be certified in accordance with applicable codes local ordinances.

H. System startup and testing shall be performed under the direct observation of the Architect's authorized representative. The Contractor at this time shall provide a legible half size reproduction of the original completed fire alarm red-line drawings (this copy will be retained by the Owner), an accurate copy of the fire alarm system points list, and a copy of the construction drawings on CD in AutoCad and Adobe Reader .pdf format.

I. Provide and install the most current software package available at the time of installation. In addition, when the programming software is available in disk format, a backup copy of the most up to date revision, in disk format, shall be delivered to the architect at the completion of the project. A software license agreement shall be made available for the responsible Owner representative to sign at the time of training.

1.09 WARRANTY

A. The Fire Alarm Equipment Manufacturer shall provide a 3 year material warranty. Installer shall provide a 1 year labor warranty.

B. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the manufacturer for a period of 5 years after expiration of the warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Fire alarm equipment shall be standard products of Siemens Building Technologies, Inc., or Notifier by Honeywell, Fire Lite Alarms by Honeywell, or Edwards Systems Technology, or Simplex Grinnell, or Johnson Controls. Manufacturers listed are intended to establish type and quality of equipment and system design as well as operating features required. Deviations from intended functions of specified system are not permitted. Equipment shall not be ordered or installed until such equipment has been reviewed and approved by the Architect.

2.02 FIRE ALARM CONTROL PANEL (FACP) OR NETWORK NODES

A. Furnish addressable control panel and all applicable components for fire alarm control as indicated on drawings.

B. The control panel shall contain the following:

1. Initiation device circuits.

2. Alarm indicating circuits.

3. Power supply operating at 120 volts, with overcurrent protection as required to operate the system. Over-current protection shall be provided on all power outputs. The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:

a. Ground Fault LED

b. AC Power Fail LED

4. The power supply shall provide an integral battery charger. Battery arrangement may be configured in the field.

5. Control, Interface, and Input/Output modules as required for system operation.

6. Remote station or Remote panel(s) connection(s).

7. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch keys for the field programming and control of the fire alarm system.

8. Transient voltage surge suppression.

9. Digital Alarm Communicator Transmitter (DACT) and Internet Protocol Digital Alarm Communicator Transmitter (IPDACT). The DACT is an interface for communicating digital information between a fire alarm control panel and a UL-Listed central station. When the optional IPDACT Ethernet module is connected to the on board DACT, the system shall be capable of transmitting contact ID formatted alarms to a central station equipped with a compatible IP receiver via Ethernet over a private or public WAN/LAN, Intranet or Ethernet.

   a. The IPDACT communicator shall be an integral module component of the fire alarm control panel enclosure.

   b. The IPDACT communicator shall include connections to the alarm panel's phone outputs and shall convert the contact ID protocol in DTMF form into UDP Ethernet Packets. It shall include the ability for simultaneous reporting of panel events up to three different IP addresses.

   c. The IPDACT communicator shall be completely field-programmable locally from a PC via a serial port or via Ethernet and Telnet.

   d. The IPDACT communicator shall be capable of transmitting events in contact ID format.

C. Enclosures:

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer’s standard finish.

2. The back box and door shall be constructed of steel with provisions for electrical conduit connections into the sides and top.

3. The supplied door shall include a key lock and shall include glass or other transparent opening for viewing of all indicators. For convenience, the door may be site configured for either right or left hand hinging.

2.03 REMOTE ANNUNCIATORS

A. Furnish remote annunciator(s) and all applicable components for fire alarm remote annunciator as indicated on drawings.

B. The remote annunciator shall be flush mounted with protective cover and contain the following:

1. LCD display that shows the local status of the fire alarm system.
2. LED's that illuminate when ALARM, SUPERVISORY, TROUBLE, and SECURITY events occur on the system.
3. A (4) line, minimum, liquid-crystal display (LCD) that will give details of the event in alphanumeric form. The display shall be capable of being toggled to display additional events.
4. Three (3) additional control buttons to acknowledge events, silence audible circuits, and reset the system.

2.04 PERIPHERAL DEVICES AND EQUIPMENT

A. Manual Stations:

B. Smoke Detectors:

C. Smoke Detectors with audible bases:

D. Duct Smoke Detectors:

E. Alarm Indicating Devices:

1. Horn/Strobe:
2. Strobe only:

F. Door Holder/Releases:

1. Door holder power supply:

G. Output Cables and Conductors:

1. Alarm Horn Circuit(s), one pair 16 gage solid copper, unshielded.
2. Alarm Strobe Circuit(s), one pair 16 gage solid copper, unshielded.
3. Initiating Device Circuit(s), 2-conductor 18 gage stranded copper, unshielded.

The above cable types are based on the recommendations and approval of the specified system. If the submitted and approved fire alarm system requires a different cable configuration with additional conductors, multi-conductor versus twisted pairs, etc. than is specified above, the contractor shall request a substitution to supply and install the approved configuration of cables as required by the make and model of the fire alarm system that is to be installed.

PART 3 - EXECUTION

3.01 GENERAL

A. Fire alarm system shall not be used for any purpose other than fire alarm functions.

B. Fire alarm shall be interconnected but not limited to the following systems:

1. All systems required by code to be connected to the fire alarm systems shall be connected.
2. Ventilation systems where required for the purpose of fan shutdown

3.02 SYSTEM INSTALLATION

A. Install required conductors to devices indicated on Drawings. Provide required conductor terminations to devices for a complete system to function as specified and indicated on Drawings.

B. Splices are not allowed in junction boxes. Terminations shall be in terminal cabinets or on equipment terminals.

C. Conductors shall be installed within conduits, boxes, and terminal cabinets in a totally enclosed installation. Furnish and install conductors required to connect incoming and outgoing circuits, including spare conductors, to terminal strips within terminal cabinets.

D. Wiring within equipment and terminal cabinets shall be installed to conform to contract documentation and NFPA 72 standards, and shall be terminated on terminal blocks having terminals for connections. Wiring shall be securely fastened in place so that no weight is imposed on equipment or terminals.

E. Install required terminal blocks within terminal cabinets.

F. Conductors shall be color-coded and tagged with code markers at terminal cabinets and equipment. A wire index shall be typed and installed on terminal cabinet doors. Index shall be covered with clear plastic adhesive covers. Wiring shall be identified as to building and location of devices in the index.

G. Wiring within equipment and terminal cabinets shall be carefully strapped, and shall be formed in rectangular configuration. Wires shall be properly numbered in numerical order and shall maintain same number throughout the Project site.

H. Complete installation shall comply with local building codes and applicable provisions of the National Electrical Code, and the NFPA 72 National Fire Alarm Code.

I. Location of outlet boxes and equipment on Drawings is approximate, unless dimensions are indicated. Do not scale Drawings to determine locations and routing of conduits and outlet boxes. Location of outlet boxes and equipment shall conform to architectural features of the building and other Work already in place, and must be ascertained in the field before the start of Work.

J. Devices shown at exterior locations shall be weatherproof devices, provided with weatherproof back boxes, and shall contain all provisions for weatherproof installations.

K. Drawings generally indicate Work to be provided, but do not indicate all bends, transitions or special fittings required to clear beams, girders or other Work already in place. Investigate conditions where conduits are to be installed, and furnish and install required fittings.

L. Provide adhesive, typed label of approximately 1 inch wide with red lettering for each initiating device that is hidden from view. Tags shall indicate the address of the device.

3.03 TESTING

A. Testing of fire detection system shall be as required by the Fire Marshal and local authorities having jurisdiction. Installer is responsible for identifying required testing, coordinating, scheduling, and conducting tests before Substantial Completion; one week notice of scheduled fire marshal test shall be provided to the engineer before final testing.

B. Complete the inspection and testing form as required by NFPA 72, and submit one copy of the completed form to the Architect and Engineer.

C. Contractor shall pretest system and clear all defects prior to scheduling final testing with fire marshal and architect/engineer.

3.04 SERVICE MANUALS

A. Contractor shall deliver upon completion of project, 3 copies of the service manuals. Each manual shall include the following:

1. Installation manuals, programming manuals and user manuals for all fire alarm components. Catalog cut sheets are not acceptable.
2. A printed copy of the system configuration as programmed, including all system labeling codes, and passwords.
3. An electronic copy on compact disk of the system configuration program
4. Final test report.
5. Detailed explanation of the operation of the system.
6. Instructions for routine maintenance.
7. Detailed final wiring diagram for the system, and an electronic copy (CD) of the posted system in Auto-Cad and pdf formats.
8. Provide codes and passwords for fire alarm system at testing.

3.05 SPARE PARTS

A. The following new spare parts shall be furnished in unopened boxes:

1. 5% spare pull stations including the associated monitor module (minimum one spare pull station per type).
2. 5% spare smoke and heat detectors (minimum one spare smoke and heat detector per type).
3. 5% spare audible devices (minimum one spare audible device per type).
4. 5% spare strobe devices (minimum one spare strobe device per type).

3.06 SYSTEM USER AND MAINTENANCE PERSONNEL TRAINING

A. Before Substantial Completion, provide one instruction period for the Project site based Owner operators and system users. The instruction period shall be scheduled and coordinated with the owner's representative.

B. All training materials and required deliverables shall be submitted to the owner's representative.

3.07 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.08 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

END OF SECTION

31 10 00 - SITE CLEARING

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.

1.2 SCOPE:

A. The work required under this section consists of clearing and grubbing of area within construction limits and related items to complete the work as indicated on the drawings and described in the specifications.

1.3 DESCRIPTION OF WORK:

A. Site clearing work includes, but is not limited to:

1. Protection of existing trees.
2. Removal of trees and other vegetation.
3. Topsoil stripping.
4. Clearing and grubbing.
5. Removing above-grade improvements.
6. Removing below-grade improvements.

1.4 JOB CONDITIONS:

A. Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

Protect improvements on adjoining properties and on Owner's property.

Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.

C. Salable Improvements: Carefully remove items indicated to be salvaged, and store on Owner's premises where indicated or directed.

PART 2 - PRODUCTS

Not applicable to work of this section.

PART 3 - EXECUTION

3.1 SITE CLEARING:

A. General: Remove trees, shrubs, grass and other vegetation, improvements, or obstructions interfering with installation of new construction. Remove such items elsewhere on site or premises as specifically indicated. Removal includes digging out stumps and roots.

Carefully and cleanly cut roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction.

B. Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4". Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2" in diameter, and without weeds, roots, and other objectionable material.

Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.

Remove heavy growths of grass from areas before stripping.

Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to main root system.

Stockpile topsoil in storage piles. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent wind-blown dust.

C. Dispose of unsuitable or excess topsoil same as waste material, herein specified.

D. Clearing and Grubbing: Clear site of trees, shrubs and other vegetation, except for those indicated to be left standing.

Completely remove stumps, roots, and other debris protruding through ground surface or within building lines.

Use only hand methods for grubbing inside drip line of trees indicated to be left standing.

Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

Place fill material in horizontal layers not exceeding 6" loose depth, and thoroughly compact to a density equal to adjacent original ground.

E. Removal of Improvements: Remove existing above-grade and below-grade improvements necessary to permit construction, and other work as indicated including but not limited to pipe, sidewalks, paving, foundations, buildings, walls, etc.

Abandonment or removal of certain underground pipe or conduits may be shown on mechanical or electrical drawings, and is included under work of those sections. Removal of abandoned underground piping or conduit interfering with construction is included under this section.

3.2 DISPOSAL OF WASTE MATERIALS:

A. Burning on Owner's Property: Burning is not permitted on Owner's property.

B. Removal from Owner's Property: Remove waste materials and unsuitable and excess topsoil from Owner's property and dispose of off site in legal manner.

(END OF SECTION 31 10 00)

31 20 00 - EARTHWORK

PART 1 - GENERAL

1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of earthwork is indicated on drawings and described herein.

1. Site grading to elevations indicated on drawings is included as part of this work.

2. Preparation of subgrade for building slabs, walks, and pavements is included as part of this work.

3. Soil compaction and control is included as a part of this work.

4. Backfilling of trenches within building lines is included as part of this work.

B. Excavation of Mechanical/Electrical Work: Refer to Mechanical and Electrical sections for excavation required in conjunction with underground mechanical and electrical utilities, backfilling of excavated trenches shall be in accordance with this section.

C. Definition: "Excavation" consists of removal of material encountered to subgrade elevations indicated and subsequent disposal or relocation of materials removed.

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Service: Owner will employ a testing laboratory to perform soil testing and inspection service for quality control testing during earthwork operations.

1.4 JOB CONDITIONS:

A. Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

B. Use of Explosives: The use of explosives is not permitted.

C. Protection of Persons and Property: Barricade open excavations occurring as part of this work.

Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS:

A. Clean Free Sand Fill shall be "River Sand" or approved equal.

B. Red Clay Sand: All fill shall have a liquid limit of not more than 25 and a plasticity index (P.I.) of no less than 8 and no greater than 12.

C. Washed Gravel shall be graded clean, washed pea gravel.

D. Select on Site Material shall be non-organic material of the optimum moisture content that will allow the prescribed compaction and approved for use outside of building area by testing laboratory. No material removed as unsuitable bearing material shall be approved as select on-site material.

E. Backfill and Fill Materials: Satisfactory soil must be one of the above materials free of clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter.

PART 3 - EXECUTION

3.1 EXCAVATION:

A. Earth Excavation includes excavation of pavements and other obstructions visible on ground surface; underground structures, utilities and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.

B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be at contractor's expense.

Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom without altering required top elevation.

Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Architect.

C. Additional Excavation: Where excavation has reached required subgrade elevations, notify Architect who will make an inspection of conditions.

If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Architect.

Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.

D. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

Maintain sides and slopes of excavations in safe condition until completion of backfilling.

E. Shoring and Bracing: Provide materials for shoring and bracing in good serviceable condition.

Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

F. Dewatering: Prevent surface water from flowing into excavations and from flooding project site, surrounding area and existing building.

G. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

H. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

Dispose of excess soil material and waste materials as herein specified.

I. Excavation for Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10', and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

J. Excavation for Pavements: Cut surface under pavements to comply with elevations and grades as shown making provisions for 8" minimum red sandy clay.

K. Excavation for Trenches: Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6" to 9" clearance on both sides of pipe or conduit.

Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freezing.

Except as otherwise indicated, excavate for exterior water-bearing piping (water, steam, condensate, drainage) so top of piping is not less than 2'0" below finished grade.

Grade bottoms of trenches as indicated, including notching under pipe bells to provide solid bearing for entire body of pipe.

Backfill trenches with concrete where trench excavations pass within 18" of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing.

Concrete is specified in Division 3.

Do not backfill trenches until tests and inspections have been made and backfilling authorized by Architect. Use care in backfilling to avoid damage or displacement of pipe systems.

3.2 COMPACTION:

A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.

B. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density.

1. Structures, Building Slabs and Steps, Pavements: Compact 9” loose lifts for all layers of backfill or fill material at 95% standard proctor (ASTM D-698) within 3% of optimum moisture.

2. Lawn or Unpaved Areas: Compact top 6" of subgrade and each layer of backfill or fill material at 90% maximum density.

3. Walkways: Compact top 6" of subgrade and each layer of backfill or fill material at 95% maximum density.

C. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.3 BACKFILL AND FILL:

A. General: Place acceptable soil material in layers in required subgrade elevations, for each area classification listed below.

B. Outside Building Area: Use select on-site material or red clay sand against foundation walls, under grassed areas, trenches, and piping areas not indicated to be paved shall have a minimum of 2" of topsoil.

C. Under Walks and Pavement: Use select on-site material or red clay-sand except top eight inches shall be red clay-sand. Cut existing grade as necessary to maintain 8" of red clay-sand.

D. Inside Building Area: Areas requiring fill within building boundaries, the top two feet of fill shall be red clay-sand. In the areas requiring fill below this top two feet, a select on-site material may be used if available.

E. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing and waterproofing.

2. Inspection, testing, approval, and recording locations of underground utilities.

3. Removal of concrete formwork.

4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.

5. Removal of trash and debris.

6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

F. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than one vertical to four horizontal so that fill material will bond with existing surface.

When existing ground surface has a density less than that specified under "Compaction" for particular area classification. Break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

G. Placement and Compaction: Place backfill and fill materials in layers not more than 9" under building and 12" outside building in loose depth for material compacted by heavy compaction equipment, and not more than 6" in loose depth for material compacted by hand-operated tampers.

Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

Place backfill and fill materials evenly adjacent to structures, piping or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

3.4 GRADING:

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding.

Finish surfaces free from irregular surface changes, and as follows:

1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10' above or below required subgrade elevations.

2. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10' above or below required sub-grade elevation.

3. Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2" above or below required subgrade elevation.

C. Grading Surface of Fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2" when tested with a 10' straightedge.

D. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

If in opinion of Architect based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

3.5 FIELD QUALITY CONTROL:

A. Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.

1. Paved Areas and Building Slab Subgrade: Make at least one field density test of subgrade for every 2000 sq. ft. of paved area or building slab, but in no case less than three tests. In each compacted fill layer, make one field density test for every 2000 sq. ft.of overlaying building slab or paved area, but in no case less than three tests.

2. Foundation Wall Backfill: Take at least two field density tests at locations and elevations as directed.

3.6 MAINTENANCE:

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

C. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.7 DISPOSAL OF EXCESS AND WASTE MATERIALS:

A. Removal from Owner's Property: Remove waste materials, including unacceptable and acceptable excavated material, trash and debris, and dispose of it off Owner's property.

(END OF SECTION 31 20 00)

31 25 00 – EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Provide labor, material and equipment for temporary and permanent management practices as shown on the plans and as directed by the Architect during the life of the Contract to control erosion, storm water runoff and pollution through the use of Best Management Practices.

B. Coordinate temporary erosion control provisions with permanent erosion control features to assure economical, effective and continuous erosion, sedimentation and pollution control throughout the construction and stabilization period.

C. Management practices required are not limited to the measures shown on the plans. Provide additional practices necessitated by actual conditions and methods.

D. Silt and pollution leaving the site and any effects of the release are the sole and total responsibility of the Contractor.

E. Contractor shall be responsible for requiring all Subcontractors to comply with the Erosion and Sedimentation Control Plan.

1.2 RELATED DOCUMENTS:

A. Permanent Grassing shall comply with Section 32 92 00 – Turfs and Grasses.

B. All erosion and sedimentation control work shall comply with the Mississippi Department of Environmental Quality, Erosion Control, Sediment Control and Storm Water Management on Construction Sites and Urban Areas Manual (Three Volumes), latest edition.

PART 2 - PRODUCTS

2.1 SILT FENCE

A. Geotextile filter fabric: The geotextile shall conform to the physical requirements of Type II filter fabric.

B. Wire Backing: The wire backing shall be at least 32 inches high and have no less than six horizontal wires. Vertical wires shall be spaced no more than 12 inches apart. The top and bottom wire shall be 10 gage or larger. All other wire shall be no smaller than 12 ½ gage.

C. Posts: Posts shall be steel tee posts a minimum of 5 feet in length. The posts shall have projections, notches or holes for fastening the wire backing or geotextile to the posts.

2.2 WATTLES

A. Wattles shall be 24” diameter and shall meet the requirements of the Mississippi

Standard Specifications For State Aid Road and Bridge Construction.

2.3 RIP-RAP

A. General: Stone without grout as described in Section S-815 of the Mississippi Standard Specifications for Road and Bridge Construction, Mississippi State Highway Department, 1989 Edition. Broken concrete or concrete-filled bags not allowed. Stone size: minimum 20 lbs. per stone, maximum 150 lbs. per stone, with 80% of stones by weight not less than 30 lbs. per stone, however, 10% of the total weight may be less than the minimum weight.

1. Filter Fabric: Woven construction fabric, Amoco Embankment/Erosion Control Fabric Number 1198, as manufactured by Amoco Fabrics and Fibers Company, Atlanta, Georgia, or approved equal.

2. Place rip-rap over secured filter fabric in locations shown on the plans. Prepare all slopes to a 3:1 ratio before application.

2.4 CONSTRUCTION ENTRANCE

A. Heavy duty stone aggregate and filter fabric construction entrance, complying with the requirements MDEQ Manual's Best Management Practices.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install management practices in accordance with the plans and specifications.

B. Maintain management practices throughout construction and until the site is finally stabilized.

3.2 LIMITS OF CONSTRUCTION

A. Limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and fill operations. Provide immediate permanent or temporary erosion control measures to prevent contamination of adjacent watercourse, lakes, ponds, other water of the State. Seed and mulch cut and fill slopes as excavation proceeds to the extent possible.

B. Incorporate all permanent management practices into the project at the earliest practicable time in the activity schedule. Use temporary management practices to correct conditions that develop during construction; that are needed prior to installation of permanent pollution control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

C. Schedule and perform clearing and grubbing operations so that grading operations and permanent management practices can be installed before or immediately thereafter.

3.3 MAINTENANCE

A. Maintain temporary management practices until no longer needed or permanent management practices are provided and the site is stabilized. Remove temporary materials.

B. In the event that temporary management practices are required due to negligence, carelessness or failure to provide permanent management practices as a part of work scheduled, provide at no cost to the Owner.

C. When silt deposited in sediment controls structures occupies more than 50% of the capacity, remove the silt and restore the controls to the conditions and grades shown on the plans.

(END OF SECTION 31 25 00)

SECTION 31 31 16 – TERMITE CONTROL

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Soil treatment with termiticide.

a. Provide treatment at all new construction and areas where ground is exposed during demolition activities (i.e. new structure, relocation of plumbing).

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include the EPA-Registered Label.

B. Product certificates.

C. 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.

1.3 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.

1.4 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

2.1 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

3.1 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.

3.2 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.

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

32 12 73 – CONCRETE JOINT SEALANT

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Section includes sealing control and expansion joints in concrete sidewalks, parking lots, and driveways.

1.2 WORK INCLUDED:

A. Work under this section includes providing all labor, material, and equipment to seal the contraction, control, and expansion joints in concrete sidewalk, parking lot and driveway pavements.

PART 2 - PRODUCTS

2.1 EXPANSION JOINT MATERIAL

A. Expansion joint material shall be ½" thick, full depth, pre-molded non-bituminous joint material, with the top ½" perforated for removal prior to sealing operations.

2.2 JOINT FILLER

A. One or two component polysulfide polymer sealant or a one or two component polyurethane prepolymer sealant

B. Color: Gray

2.3 BACKER ROD

A. Closed cell polyethafoam sealant backer road; sized as required

PART 3 - EXECUTION

3.1 PREPARATION:

A. Saw control joints in accordance with the drawings and specifications.

B. Seal joints following the sawing operation or as soon as possible thereafter.

3.2 GENERAL:

A. Manufacturer's recommendations on the joint sealer shall be strictly adhered to with the following additions:

1. Leave joint sealant approximately 1/16" below the pavement surface level to prevent tracking.

2. Sprinkle fine silica sand, as needed, to reduce tracking of the joint sealer.

3.3 INSTALLATION

A. Remove the perforated portion of the expansion joint material prior to placing the joint sealant.

B. Clean loose material from the joints with compressed air.

C. In contraction joints, place a polyethafoam sealant backer road of 5/16” to 3/8” below the surface elevation of the sidewalk. Install the backer rod at uniform depth.

D. Install expansion and construction joint sealant to approximately 1/16” below the sidewalk surface level.

(END OF SECTION 32 12 73)

32 13 13 – SITE WORK CONCRETE

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 specified in this section.

1.2 DESCRIPTION OF WORK:

A. Extent of work is shown on drawings, including curbs, gutters, walks.

B. Prepared subbase is specified in "Earthwork" section.

C. Concrete and related materials are specified in Division 3.

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Comply with local governing regulations if more stringent than herein specified. Joint Sealers to be installed by approved applicator.

1.4 JOB CONDITIONS:

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required to maintain indicated parking areas during construction.

Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

Use flexible spring steel forms or laminated boards to form radius bends as required.

Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric.

Sidewalks----------6 x 6 #10

C. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 40.

D. Moisture Barrier: 6 mil polyethylene.

E. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 40. Cut bars to 2'0" length with ends square and free of burrs.

F. Concrete Materials: Comply with requirements of applicable Division 3 sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.

G. Expansion Joint Material: to be asphalt impregnated 1/2" thick meeting ASTM-D-1751.

H. Expansion Joint Cap: Greenstreak #941 plastic cap for 1/2" joints.

I. Joint Sealant: Woodmont 550 pour grade urethane. Color shall be concrete.

J. Curing and Sealing Compound: Conform to TT-C-800, with 30% solids content minimum.

K. Epoxy Resin Grout: FS MMM-G-650.

2.2 CONCRETE MIX, DESIGN AND TESTING:

A. Comply with requirements of applicable Division 3 sections for concrete mix design, sampling and testing, and quality control, and as herein specified.

B. Design mix to product normal-weight concrete consisting of Portland cement, aggregate, water-reducing or high-range water-reducing admixture (super-plasticizer), air-entraining admixture and water to produce the following properties:

1. Compressive Strength: 3000 psi, minimum at 28 days.

2. Slump Range: 8" for concrete containing HRWR admixture (super-plasticizer); 4" for other concrete.

3. Air Content: 5% to 8%.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION:

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.2 FORM CONSTRUCTION:

A. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork for grade and alignment to following tolerances:

1. Top of forms not more than 1/8" in 10'.

2. Vertical face on longitudinal axis, not more than1/4" in 10'.

C. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

3.3 REINFORCEMENT:

A. Locate, place and support reinforcement as specified in Division 3 sections, unless otherwise indicated.

B. Moisture Barrier: Provide a 6 mil Polyethylene moisture barrier under all concrete walks.

3.4 CONCRETE PLACEMENT:

A. General: Comply with requirements of Division 3 sections for mixing and placing concrete, and as herein specified.

Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place a construction joint.

B. Curbs and Gutters: Automatic machine may be used for curb and gutter placement at contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.

3.5 JOINTS:

A. General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

C. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.

Locate expansion joints at 20' o.c., each direction for each pavement lane, unless otherwise indicated.

Use load transfer-slip dowel devices 2'0" long, installed so that one end of each dowel bar is free to move.

Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface.

Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.

Install expansion joint cap on premoulded expansion joint material and protect until concrete has been placed on each side.

Protect top edge of joint filler cap during concrete placement. Remove protection after concrete has been placed on both sides of joint.

D. Joint Sealers: Remove plastic cap and provide joint sealant in all expansion joints and comply with manufacturers instructions.

3.6 CONCRETE FINISHING:

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

C. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

D. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Broom finish, on all sidewalks, and curb and gutters by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Architect.

2. Do not remove forms for twenty-four hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects as directed by Architect.

3.7 CURING:

A. Protect and cure finished concrete walks, complying with applicable requirements of Division 3 sections. Use curing and sealing compound or approved moist-curing methods.

REPAIRS AND PROTECTIONS:

A. Repair or replace broken or defective concrete as directed by Architect.

B. Drill test cores where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy resin grout.

C. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least fourteen days after placement. When construction traffic is permitted, maintain concrete work as clean as possible by removing surface stains and spillage of materials as they occur.

D. Sweep concrete and wash free of stains, discolorations, dirt and other foreign

material just prior to final inspection.

(END OF SECTION 32 13 13)

SECTION 329200 – TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section

1.2 SUMMARY

A. Section Includes:
   1. Seeding.
   2. Sodding.

B. DESCRIPTION OF WORK

1. Provide all materials and equipment, and do all work required to complete the loaming, seeding and sodding including furnishings and placing topsoil, as indicated on the Drawings and as specified.

C. RELATED WORK

1. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

   a. Section 312000 – EARTHWORK.

1.3 DEFINITIONS

A. Compaction: A loss of soil aggregates; destroyed aeration pore spaces; crushed or collapsed pore spaces; and, undergone extensive resorting and packing of soil particles.

B. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

C. Finish Grade: Elevation of finished surface of planting soil.

D. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

E. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides,

rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

F. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

G. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

H. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

I. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

J. Surface Soil: Whatever soil is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

K. Turfgrass: A contiguous community of grass plants that have the ability to withstand mowing and reasonable foot traffic.

1.4 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM)

C 136 Sieve Analysis of Fine and Coarse Aggregates

E 11 Wire-Cloth Sieves for Testing Purposes

1.5 SUBMITTALS

A. Samples: The following samples shall be submitted:

Material	Quantity (lb.)
Topsoil	1
Composted Soil Admixture	1
Fertilizer	1

B. Manufacturer’s Product Data: Manufacturer’s product data shall be submitted for the following materials if to be used on the project:

Aluminum sulfate

Fertilizer
Lime

C. Certificates: Labels from the manufacturer's container certifying that the product meets the specified requirements shall be submitted for the following materials:

Grass seed mix (each)	Commercial fertilizer
Ground limestone	Seed mix for sod

D. Gradation and laboratory analysis: Gradation of granular materials shall be determined in accordance with ASTM C 136. Sieves for determining material gradation shall be as described in ASTM E 11. Test results that meet the specified requirements shall be submitted for the following materials:

Topsoil without Admixture
Topsoil with Admixtures

1.6 QUALITY ASSURANCE

A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project Site when work is in progress.

1. Pesticide Applicator: State licensed, commercial.

B. Soil Analysis:

1. Unless otherwise provided, the Contractor shall engage an independent testing agency, experienced in the testing of agricultural soils and acceptable to the Landscape Architect, to perform the following tests and analyses:

Material	Tests and Analysis Required
Soils	Mechanical analysis of soil indicating the percent passing by weight of the following sieve sizes: 1 in., 1/2 in., No. 4, No. 10, No. 100, and No. 200. Determination of pH, organic content, and nutrient content. Recommendations shall be made by the testing agency as to the type and quantity of soil additives required to bring pH, organic content, and nutrient content to satisfactory levels for planting and grassing.
Organic Amendments	Determination of moisture absorption capacity, organic matter content, and pH.

2. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.

3. Gradation of granular materials shall be determined in accordance with ASTM C 136. Sieves for determining material gradation shall be as described in ASTM E 11.

C. Turfgrass:

1. The Contractor shall provide quality, genus, species, and variety of turfgrass indicated.

2. No changes or substitutions may be made without prior approval by the Landscape Architect, and municipal authority, if applicable.

D. Owner's Inspection And Testing

Work may be subject to inspection at any time by the Landscape Architect. The Owner reserves the right to engage an independent testing laboratory in accordance with requirements of Section 140000 – QUALITY CONTROL to analyze and test materials used in the construction of the work. Where directed by the Landscape Architect, the testing laboratory will make material analyses and will report to the Landscape Architect whether materials conform to the requirements of this specification.

1. Cost of tests and material analyses made by the testing laboratory will be borne by the Owner when they indicate compliance with the specification, and by the Contractor when they indicate non-compliance.

2. Testing equipment will be provided by and tests performed by the testing laboratory. Upon request by the Landscape Architect or Owner, the Contractor shall provide such auxiliary personnel and services needed to accomplish the testing work and to repair damage caused thereto by the permanent work.

E. Contractor's Inspection And Testing

1. Testing, analyses, and inspection required by the Contractor for his own information or guidance shall be at his own expense.

2. Materials shall not be used in construction until test results have been reviewed by the Landscape Architect.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials:

1. Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

2. Deliver fertilizer in sealed waterproof bags, printed with manufacturer’s name, weight, and guaranteed analysis.

B. Sod: Turfgrass sod is a living, perishable product. Generally, all sod should be unrolled within 24 to 30 hours from time of harvest. During periods of 85 F degree (29 C) or higher, additional efforts must be made to reduce the amount of time between harvest and unrolling. Protect sod from breakage and drying.

1. Harvesting Sod:

    a. Sod shall not be harvested at the nursery or approved source until ready to transport sod to the site of the work or acceptable storage location.

    b. Before harvesting, sod shall be mowed at a uniform height of 2 in. (50 mm) or as required.

    c. Cut sod to consistent width and length as specified.

2. Transportation of Sod:

    a. Sod transported to the Project in open vehicles shall be covered with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury. Closed vehicles shall be adequately ventilated to prevent overheating of the sod.

    b. Evidence of inadequate protection following the digging, carelessness while in transit, or improper handling or storage, shall be cause for rejection.

    c. Sod shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the sod is in transit, being handled, or is in temporary storage.

    d. Upon arrival at the temporary storage location or the site of the work, sod material shall be inspected for proper shipping procedures. Should the grass reach the permanent wilt point, the Landscape Architect will reject the sod. When sod has been rejected, the Contractor shall at once remove it from the area of the work and replace it with acceptable material.

    e. Unless otherwise authorized by the Landscape Architect, the Contractor shall notify the Landscape Architect at least two working days in advance of the anticipated delivery date of sod material. Certificate of Inspection when required shall accompany each shipment.

3. Handling and Storage of Sod:

    a. Sod material shall be handled with extreme care to avoid breaking or tearing strips.

    b. Sod shall not be stored for longer than 24 hours prior to installation unless approved by the Landscape Architect. Sod shall be stored in a compact group and shall be kept moist. Sod shall be prevented from freezing.

    c. Sod that has been damaged by poor handling or improper storage will be rejected by the Landscape Architect.

1.8 PLANTING SEASON AND CONDITIONS

A. Planting season for seeding shall be as follows:

Item	Planting Period
Seed Mix	Late summer, early fall preferred
Wetland Seed Mix /straw mulch	Spring preferred; increase rates per mfr. recommendations

B. Planting season for sod shall be all season, except on frozen soil.

C. Planting shall only be performed when weather and soil conditions are suitable for planting the material specified in accordance with locally accepted practice.

1.9 MAINTENANCE

A. Turfgrass shall be maintained by the Contractor until Substantial Completion, as described in Part 3 of this Section.

B. Following Substantial Completion, maintenance of turfgrass shall become the Owner's responsibility with the following provisions.

1. The Contractor shall provide Owner with written recommended maintenance program at time of Substantial Completion.

2. The Contractor may make as many periodic inspections as necessary during the guarantee period, at no additional cost to the Owner, to inspect the condition of all plant materials. Submit written report of each inspection to the Landscape Architect and Owner outlining corrective measures required to keep the guarantee valid.

1.10 ACCEPTANCE

A. Acceptance:

1. The Landscape Architect will inspect all work for Substantial Completion upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.

2. Acceptance of material by the Landscape Architect will be for general conformance to specified requirements, and shall not relieve the Contractor of responsibility for full conformance to the Contract Documents.

3. Upon satisfactory completion and re-inspection of all repairs or renewals necessary in the judgment of the Landscape Architect, the Landscape Architect will recommend to the Owner that the work of this Section be accepted.

B. Sod and seed areas will be accepted when in compliance with all the following conditions:

1. Roots are thoroughly knit to the soil;

2. Absence of visible joints (sodded areas);

3. All areas show a uniform stand of specified grass in healthy condition, individual bare spots of under 72 square inches or multiple bare spots not in excess of 1 percent of the area.

4. At least 60 days have elapsed since the completion of work under this Section, or as approved by the Landscape Architect.

5. A minimum amount of weeds may be acceptable, commensurate with the intended use.

PART 2 - PRODUCTS

2.1 SEED

A. Seed: Fresh, clean, dry, new-crop seed with clear percentages of the pure live seed (PLS) and bulk seed present.

B. Turfgrass: It shall be standard grade seed of the most recent season's crop, with 0.5 percent or less weed seed, 1.75 percetnt or less crop seed by weight, and minimum 95 percent purity with minimum 85 percent germination. Seed shall be dry and free of mold. Seed shall meet the following requirements.

C. Turf Grass Seed Species: Provide as follows:

1. Full Sun: Centipede

2. Partial Shade: Centipede

3. Shade: Centipede

2.2 TURFGRASS SOD

A. Turfgrass Sod: Comply with "Specifications for Turfgrass Sod Materials" in Turfgrass Producers International's (TPI) "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: Sod shall be comprised of grass species as follows:

1. Full Sun: Proportioned by weight as follows: Centipede.

2. Sun and Partial Shade: Proportioned by weight as follows: Centipede

3. Shade: Proportioned by weight as follows: Centipede

C. Sod shall be nursery grown on cultivated mineral agricultural soils. Sod shall have been mowed regularly and carefully, and otherwise maintained from planting to harvest.

D. Thickness of Cut: Sod shall be machine cut at a uniform soil thickness of a 5/8 inch (16 mm), plus or minus a ¼ inch (6 mm), at the time of cutting. Measurement for thickness shall exclude top growth and thatch.

E. Section Size: Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus a ½ inch (12 mm) on width, and plus or minus 5 percent on length. Broken strips and torn and uneven ends will not be acceptable.

F. Strength of Sod Strips: A standard section of sod, 6 feet (2 m) in length, shall be strong enough to support its own weight and retain its size and shape during installation.

G. Moisture Content: Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.

H. Time Limitations: Sod shall be harvested, delivered, and transplanted within 24 to 30 hours from time of harvest unless a suitable preservation method is approved prior to delivery or as weather conditions warrant. Sod not transplanted within this period shall be inspected and approved by the Landscape Architect prior to its installation.

I. Diseases, Nematodes, and Insects: Sod shall not exhibit symptoms of diseases, nematodes, or soil-borne insects.

J. Weeds: A minimum amount of weeds may be acceptable, commensurate with the intended use.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent, by weight. Class T is more finely ground and quicker acting but dustier than Class O.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.

G. Sand: Clean, washed, natural or manufactured angular grains, free of toxic materials.

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: An organic substance produced by the biological and biochemical decomposition of source separated organic materials that may include leaves and lawn trimmings, food or industrial residuals, and/or municipal biosolids. The product shall not contain levels of substances toxic to plants and shall be reasonably free (< 1 percent by dry weight) of man-made foreign matter. It shall be well-composted, stable, and substantially weed-free organic matter, pH range of 5.5 to 8 percent, moisture content 35 to 55 percent by weight; soluble salt content of <3 mmhos/cm or <3 decisiemens/m and free of substances toxic to plantings; and as follows:

1. The compost stock must mature for a minimum of 90 days. During this time, the compost stock shall achieve thermophilic temperatures (175 to 180 degrees F, 79 to 82 degrees C) for 15 days; multiple turnings may be required for the entire stockpile. A Solvita test may be requested to determine the maturity and stability of the compost.

2. Frozen or muddy compost shall be unacceptable for use.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent. Peat is an acceptable alternative to composted soil admixtures to increase organic content. Additional lime in the pelletized form shall be provided to readjust the pH.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

E. Manure: Well-rotted, unleached, stable cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

F. Mycorrhizal Fungi: Dry, organic, granular root stimulant/inoculant containing at least 5300 spores per pound (0.45 kg) of vesicular-arbuscular mycorrhizal fungi and 95 million spores per pound (0.45 kg) of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.
   1. Mycorrhizal fungi amendment shall be manufactured by one of the following, or approved equivalent:
      a) Roots
      b) Plant Health Care
      c) Mycorrhizal Applications of Oregon

2.5 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen. Nitrogen (N), Phosphorus (P) and Potassium (K) in amounts recommended in soil test results.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in amounts recommended in soil test results.

2.6 PLANTING MEDIA

A. Topsoil, whether stripped from site or supplied from off-site, shall be a sandy loam or loam soil as defined by the USDA Soil Conservation Service, Soil Classification System, and shall have the following mechanical analysis:

Textural Class	% of Total Weight	Average %
Sand (0.05-2.0 mm dia. range)	45 to 75	60
Silt (0.002-0.05 mm dia. range)	15 to 35	25
Clay (less than 0.002 m dia. range)	5 to 25	15

1. 95 percent of topsoil shall pass a .07 inch (2.0 mm) sieve.
2. Topsoil shall be free of stones 1 in (2.5 cm) in longest dimension, earth clods, plant parts, and debris. All topsoil shall be screened using a 3/8 inch (9.5 mm) screen.
3. Organic matter content shall be an average of 8 percent of total dry weight with a minimum of any sample being 6 percent.
4. Topsoil shall have a pH value range of 6.0 to 6.5.
    A. If planting soil mixture does not fall within the required pH range, limestone or aluminum sulfate shall be added to bring the pH within the specified limit.
    B. If pH is below desired level add ground limestone. If pH is above desired level add aluminum sulfate.

B. Compost Manufactured Topsoil: Uniform mixture of compost and base soil to achieve the compost manufactured topsoil product consisting of the following ingredients:

1. Compost: See above, Section 2.4, A.
2. Base soil: Topsoil and/or other soils (clay, silt, sand sand, sandy loam, or loamy sand in texture according to USDA soil classification. It shall be free of stones, clods, plant parts, weeds, and other debris >2 inches (50 mm) in any dimension. It shall not contain levels of substances that shall inhibit or be harmful to plant growth.

a. Product Parameters:

Parameter	Compost	Base Soil	Compost Manufactured Topsoil
pH	6.0-8.5	5.0-8.0	6.0-7.8
% Organic Matter	<40%	0-5%	6-20%
Particle Size	<1" (25 mm)	<2" (50 mm), USDA Class: sand, sandy loam, loamy sand	<2" (50 mm), USDA Class: sand, sandy loam, loamy sand
Salts/conductivity	Varies; must be reported	<2mmhos/cm after handling, placement & rainfall	<2mmhos/cm after handling, placement & rainfall
Carbon: Nitrogen Ratio	15-25:1	N/A	N/A

2.7 WATER

A. Water shall be suitable for irrigation and free from ingredients harmful to seeded or sodded areas.

2.8 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Hay Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

C. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

C. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Compost Mulch: Well-composted, stable, and weed-free organic matter 50 to 60 percent of dry weight; pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of [**2 to 5**] <**Insert range or value**> decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

E. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent; and a pH range of 4.5 to 6.5.

2.9 CHEMICAL PRODUCTS

A. General: Pesticides, herbicides, fungicides, bactericides or any other chemical compounds shall be registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless a licensed and authorized applicator is present. Also applications will only be done with permission in writing by authorities having jurisdiction if applicable.

1. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

2. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

3. Fungicide: Shall be zinc ethylene bisdithiocarbonate (Zineb), or equal, appled at manufacturer's suggested rates.

PART 3 - EXECUTION

3.1 PREPARATION OF SUBGRADE

A. Subgrade shall be examined to ensure that rough grading and all other subsurface work in lawn areas and other areas to be seeded is done prior to start of finish grading.

B. Existing subgrade shall be loosened or scarified to a minimum depth of 8 inches (20 cm), or as required to alleviate excessive soil compaction, prior to spreading topsoil. Subgrade shall be brought to true and uniform grade, and shall be cleared of stones greater than 2 inches (5 cm), sticks, and other extraneous material.

3.2 PREPARATION OF TOPSOIL

A. Topsoil shall not be spread until it is possible to follow immediately or within 24 hours with seeding or sodding operations. If topsoil is spread prior to this time it shall be cultivated to loosen soil prior to seeding or sodding.

B. Topsoil shall not be placed when subgrade or topsoil material are frozen, excessively wet, or excessively dry.

C. Topsoil shall be spread in a uniform layer, to a thickness, which will compact to the depth required to bring final lawn and grass surfaces to required elevation. Unless otherwise indicated minimum depth of topsoil shall be 6 inches (15 cm) after compaction.

D. Surfaces shall be graded and smoothes, eliminating all sharp breaks by rounding, scraping off bumps and ridges, and filling in holes and cuts.

3.3 FINISH GRADING

A. Final surface of topsoil immediately before seeding shall be within ± 1/2 inch (13 mm) of required elevation, with no ruts, mounds, ridges, or other faults, and no pockets or low spots in which water can collect. Stones, roots, and other debris greater than 1 in. in any dimension, which are visible at the surface, shall be removed and the resulting holes filled with topsoil, leaving a uniform planar surface.

B. Finish grade surface with a drag or rake. Round out all breaks in grade, smooth down all lumps and ridges; fill in all holes and crevices. Rolling with a light roller is acceptable, if the surface is scarified afterward.

C. In the event of settlement, the Contractor shall readjust the work to required finished grade.

3.4 SEED APPLICATION

A. Seed shall be broadcast by means of an approved mechanical seeder, to give a uniform application at the following rates:

Seed Application Rate	lb./1,000 square feet (kg./sq. m.)
[Specifier to insert seed types and rates]	

B. Seed shall be applied in two equal applications for uniform coverage; direction of travel of spreader for second pass shall be perpendicular to that of the first pass. Seeding shall not be done when it is raining or snowing, or when wind velocity exceeds 5 miles per hour. (8 km/h)

C. Following seeding the area shall be lightly raked to incorporate seed with top 1/8 to 1/4 inch (3 mm to 6 mm) of soil. Area shall then be fine graded. Stones and other debris greater than 1 in. in any dimension which are visible on surface shall be removed. Surface shall be rolled with a hand roller having a weight of 60 to 90 pounds per foot (27 to 40 kg) of width, and a minimum diameter of 2 feet (0.6 m)

D. Mulch seeded areas to prevent erosion and to protect seed from hot or dry weather or drying winds.

E. Following seeding, raking and rolling, entire area shall be watered. Initial watering shall continue until water has reached a depth of 2 inches (50 mm) over entire seeded surface, at a rate which will not dislodge the seed. Watering shall be repeated thereafter as frequently as required to prevent drying of the surface, until the grass is established. Watering methods and apparatus which may cause erosion of the surface shall not be permitted.

3.5 SODDING

A. Edges of the sodded areas shall be smooth, and all sodded areas shall conform to the design cross sections and grade. At edges adjacent to curbs, paved areas, etc., top surface of earth in sod shall be 1/2 inch (12 mm) below adjacent hard surface.

B. Sod shall be placed and all sodding operations completed within 36 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

C. On slopes 3 H:1 V or steeper, sod shall be placed perpendicular to the slope fastened in place with approved methods, spaced at not less than 1 pin per square foot.

D. Surface of completed sodded area shall be smooth. Sod shall be laid edge-to-edge, with tight-butted, staggered joints. Sod shall be carefully placed to insure that it is neither stretched or overlapped. Immediately after laying sod shall be pressed firmly into contact with sod bed by tamping or rolling, to eliminate air pockets. Following compaction, topsoil shall be used to fill all cracks, and excess soil shall be worked into grass with rakes or other suitable equipment. Sod shall not be smothered with excess fill soil.

E. Immediately after sodding operations have been completed, entire surface shall be rolled with a roller or other approved equipment weighing 100 to 160 pounds per foot (45 to 72 kg) of roller.

F. Saturate sod with fine water spray within two hours of planting, or sooner as weather conditions warrant. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 2 inches (50 mm) below sod.

3.6 HYDROSEEDING

A. Seeding may be done with the hydraulic spray method where approved. It shall be done with a commercial machine designed for the hydraulic application of seed mix in a slurry. The seed and additional material shall be mixed with sufficient water in the tank of the machine. The slurry shall be thoroughly and constantly agitated, so the materials are uniformly mixed and suspended in the water at all times until tank is emptied. The seed slurry will be uniformly distributed over the designated area to be seeded.

B. Application rates used shall conform with the manufacturer's labels for the materials used in the slurry and as soil tests dictate.

C. Hydroseeding on slopes shall conform with the manufacturer's labels for the materials used in the slurry and as soil tests dictate.

D. During the first two to three weeks or until uniform grass catch, water daily or more frequently, as necessary, to maintain moist soil to a minimum depth of 2 inches (50 mm).

E. Erosion control material, such as netting or bonded fiber matrix, shall be used when the slope or water movements dictates.

3.7 APPLICATION OF FERTILIZER AND AMENDMENTS

A. Fertilizer and conditioners shall be applied according to the Turfgrass Best Management Practices.

B. Fertilizer and supplemental conditioners shall be applied according to the type, rate, and timing recommended by the test reports from a qualified soil-testing laboratory. and in accordance with applicable industry standards.

C. Mixing with topsoil:

1. Fertilizer and conditioners shall be spread over the entire areas designated at the recommended application rates.

2. Materials shall be uniformly and thoroughly mixed into the top 4 in. of topsoil by disking, rototilling, or other approved method.

3.8 MAINTENANCE

A. Except as otherwise specified below, maintenance shall include all operations required to produce an established lawn, including but not limited to: Fertilizing, resodding, mowing, weeding, watering, or reseeding.

B. Maintenance of seeded areas shall begin upon completion of seeding and shall continue until full turf establishment and final acceptance of the lawn or seeded area.

C. Maintenance of sodded areas shall begin upon completion of sodding and shall continue until final acceptance.

D. First mowing of seeded areas shall be done when average height of grass is 3 to 5 inches (37 to 87 mm), removing no more than 1/3 of grass-leaf growth. Repeat mowing to maintain height appropriate for species without cutting more than 1/3 of grass height.

E. If lawn or grass is installed in the fall and maintenance is required to continue into spring months, lawn and grass shall receive an application of amendments and fertilizer in the spring in accordance with industry standards for new lawn establishment. Amendments and fertilizer shall be spread in a uniform layer over the entire lawn surface, as specified herein.

END OF SECTION 32 92 00

33 40 00 - STORM SEWER COLLECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of sewer collection system work is shown on drawings.

B. Sewer collection system work includes, but is not limited to, the following:

1. Storm sewer conduits.

2. Catch basins, frames and gratings.

3. Junction Boxes

4. Curb Inlets and Covers

C. Excavation and backfilling for storm sewer collection system is specified in Earthwork section.

D. Comply with the requirements of applicable Division 2 sections for excavation and backfilling required in connection with storm sewer collection system work.

E. Refer to applicable Division 3 sections for concrete work related to storm sewer collection systems.

PART 2 - PRODUCTS

2.1 CONDUIT MATERIALS:

A. General: Furnish ells, tees, reducing tees, wyes, couplings, increasers, crosses, transitions and end caps of same type and class of material as conduit, or of material having equal or superior physical and chemical properties as acceptable to the Architect.

B. Reinforced Concrete Pipe: ANSI/ASTM C 76, with modified tongue-and-groove compression gasket joints complying with ANSI/ASTM C 443.

C. Bituminous Plastic Cement: "#220-A-Mastic" as manufactured by Techni Cote Cord or "Talcote" as manufactured by Gibson-Homan.

2.2 METAL ACCESSORIES:

A. Catch Basin Frames and Gratings: Grey cast iron, heavy-duty.

B. Curb Inlet Manhole Covers: Grey cast iron, heavy-duty.

2.3 SLOT DRAIN

A. Slot drains for breezeways shall be Brickslot 200 as manufactured by ACO Drain, with heel resistant slots.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUIT:

A. General:

Install conduit in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.

Inspect conduit before installation to detect apparent defects. Mark defective materials with white paint and promptly remove from site.

Lay conduit beginning at low point of a system, true to grades and alignment indicated with unbroken continuity of invert.

Place groove end of concrete conduit facing upstream.

Install bituminous plastic cement in accordance with manufacturer's recommendations.

B. Concrete Pipe:

Install in accordance with applicable provisions of American Concrete Pipe Association "Concrete Pipe Field Manual", unless otherwise indicated.

C. Cleaning Conduit:

Clear interior of conduit of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed.

1. Place plugs in ends of uncompleted conduit at end of day, or whenever work stops.

2. Flush lines between catch basins if required to remove collected debris.

D. Joint Adapters: Make joints between cast iron pipe and other types of pipe with standard manufactured cast iron adapters and fittings.

E. Roof Drain Connections: Connect roof drains to storm drain with appropriate joint adapters.

F. Closing Abandoned Utilities: Close open ends of abandoned underground utilities which are indicated to remain in place. Provide sufficiently strong closures to withstand hydro-static or earth pressure which may result after ends of abandoned utilities have been closed.

G. Interior Inspection: Inspect conduit to determine whether line displacement or other damage has occurred.

1. Make inspections after lines between manholes, or manhole locations have been installed and approximately two feet of backfill is in place and at completion of project.

2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, correct such defects to satisfaction of Architect.

3.2 UNDERGROUND STRUCTURES:

A. Catch Basins, Junction Boxes, Curb Inlets: Construct concrete catch basins to the sizes and shapes indicated. Prefabricated catch basins, junction boxes, curb inlets, etc. boxes are acceptable, but the tops shall be poured on site.

1. Use concrete which will attain a 28-day compressive strength of not less than 3000 psi.

2. Set cast iron frames and gratings to elevations indicated.

3.3 TAP CONNECTIONS:

A. Make connections to existing conduits and underground structures, so that finished work will conform as nearly as practicable to requirements specified for new work.

B. Use commercially manufactured wyes for branch connections. Field cutting into conduit will not be permitted. Spring wyes into existing line and encase entire wye, plus 6" overlap, with not less than 6" of 3000 psi 28-day compressive strength concrete.

C. Branch connections made from side into existing 12" to 21" conduit shall have a wye sprung into the existing line, and entire wye encased with not less than 6" of 3000 psi 28-day compressive strength concrete.

3.4 BACKFILLING:

A. General: Conduct backfill operations of open-cut trenches closely following laying, jointing and bedding of pipe, and after initial inspection and testing are completed.

END OF SECTION 33 40 00